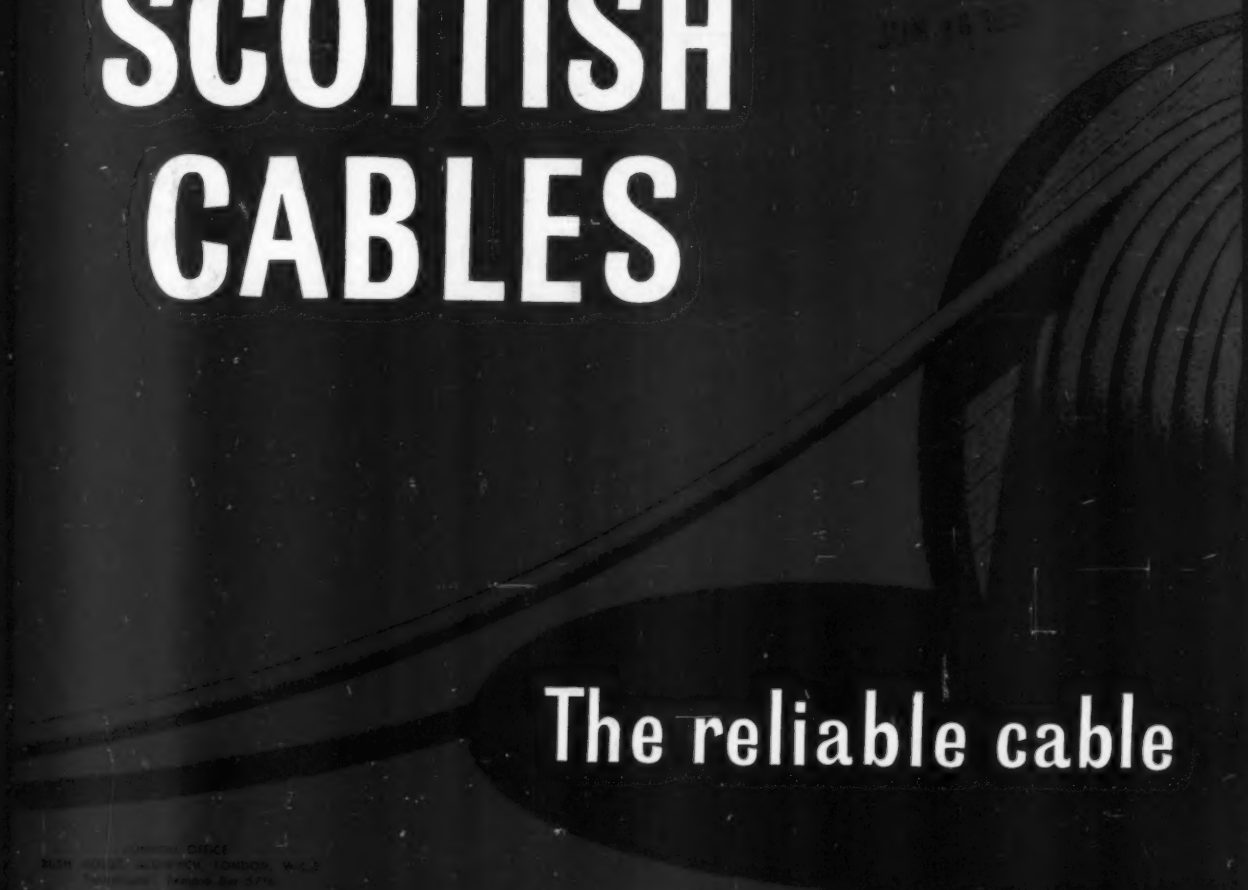
621.3

ELECTRICAL REVIEW

30 MAY 1958 PRICE 1s 6d

SCOTTISH CABLES



The reliable cable

SCOTTISH CABLES LIMITED
RENFREW SCOTLAND

SPECIFY RIST'S FOR CABLES

RIST'S

In addition to our wide range of cable manufacture, we specialise in the production of cable assemblies, leads and cords

Please write for further details

RIST'S WIRES & CABLES LTD

LOWER MILEHOUSE LANE • NEWCASTLE-UNDER-LYME • STAFFS

Heatrae

of Norwich

The HEATRAE F.B. cistern type auto-control Electric Water Heater available in a range of sizes up to 30 gallons capacity.

Write for free literature

A full range of Domestic and Industrial Water Heaters in all sizes up to 125 gallons capacity also available.

Manufacturers of Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Electric Fires, Flameproof Heating Apparatus, Food Trolleys, Warming Plates, Air Heaters. Specialists in Steam Heated Oil Heaters and Calorifizers for Shipboard.

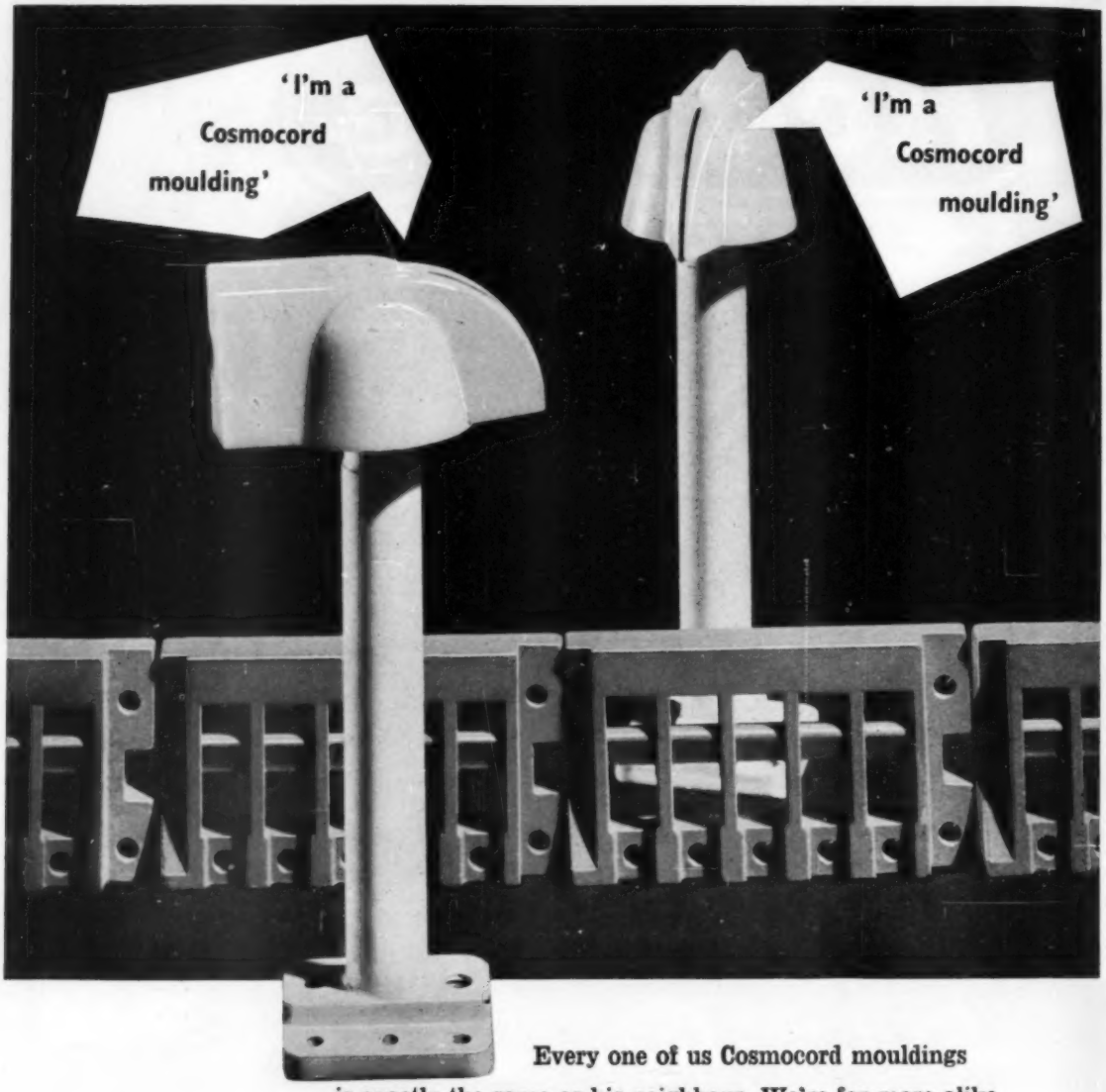
HEATRAE LIMITED

Pioneers since 1920 in all-electric water heaters

NORWICH - ENGLAND

Telegrams: HEATRAE · NORWICH Telephone: NORWICH 25131 (Private Exchange)

A



Every one of us Cosmocord mouldings is exactly the same as his neighbour. We're far more alike to each other than peas in the pod, for we keep up with each other to a thou' or two any way you measure us. Some of us are very small components, some are medium-sized handles, plugs, knobs, some are very large housings and cases.

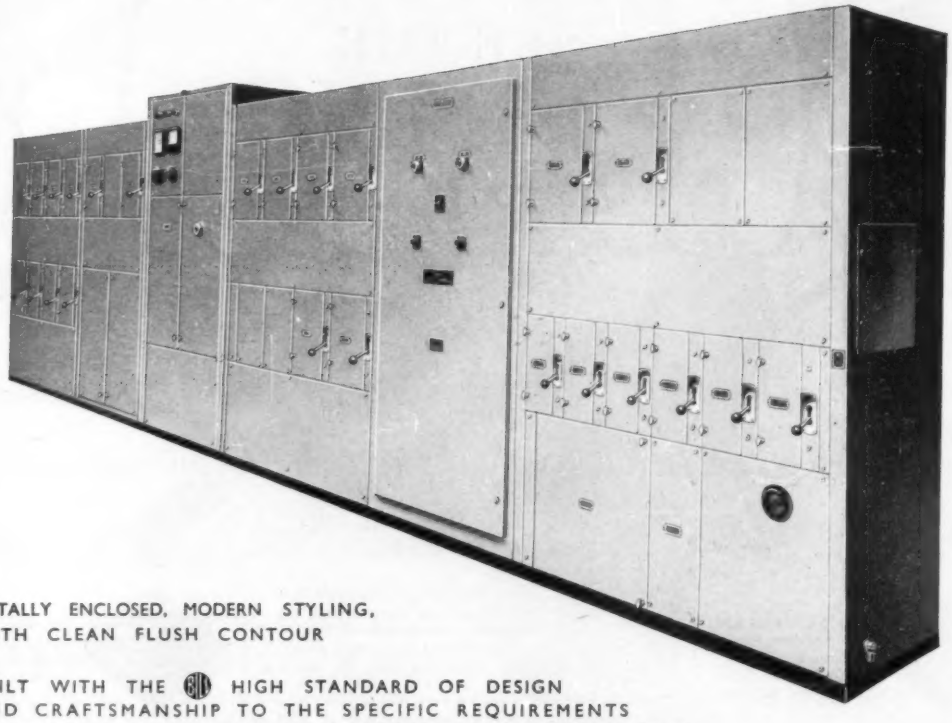
But we are all consistently good, and punctual. There's no sitting on the fence about us: ask any of the firms who use us, and they'll tell you emphatically that when you rely on Cosmocord moulding service everything in the garden is lovely.

Have it moulded by **COSMOCORD**

COSMOCORD LTD WALTHAM CROSS HERTS TEL: WALTHAM CROSS 5206 (London Subscribers please dial WA4 5206)

You cannot buy better gear

BIL MAJESTIC CUBICLE TYPE HEAVY-DUTY SWITCHBOARDS



★ TOTALLY ENCLOSED, MODERN STYLING, WITH CLEAN FLUSH CONTOUR

★ BUILT WITH THE BIL HIGH STANDARD OF DESIGN AND CRAFTSMANSHIP TO THE SPECIFIC REQUIREMENTS OF CONSULTING ENGINEERS, ARCHITECTS, AND CONTRACTORS

★ FULLY INTERLOCKED H.R.C. FUSE SWITCHES—60 TO 800 AMPERE RATING, DEVELOPED FROM THE A.S.T.A. TESTED 35.M.V.A. IMPERIAL RANGE.

★ STANDARD FINISH — A DURABLE STOVED SILVER GREY HAMMERED ENAMEL

PLEASE WRITE FOR ILLUSTRATED LEAFLET MCP. 1057.
OR ASK OUR TECHNICAL REPRESENTATIVE TO CALL.

BILL SWITCHGEAR LTD.
ASTON LANE · PERRY BARR
BIRMINGHAM·20

LONDON, S.W.1 A. W. ZELLEY, N. PAYNE, GILLINGHAM ST.
MIDLANDS G. H. GARBETT, H. WILLIAMS HEAD OFFICE
NORTH MIDLANDS C. G. BACHELOR HEAD OFFICE
EAST MIDLANDS J. A. PEARCE, HEAD OFFICE
CHELTENHAM C. GEARING, HIGH ST.
MANCHESTER 3 H. H. POLLARD, J. H. RAMSAY, F. A. MAYOR, WOOD STREET
BRISTOL 3 W. L. WHITE, CHURCH LANE
LEEDS, 7 N. SHARPLES, G. SUTTON, LOVELL RD.
GLASGOW J. D. HARRIS, I. J. HARRIS, SANDYFORD PLACE
BELFAST J. BALLENTINE DONEGALL ST.

SEE THE SPRING YOU NEED HERE ?

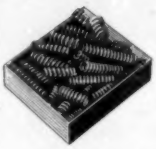
Cut production costs with TERRY Wire Circlips *(Square Section)*

We make first-class Flexible Shaft too.

May we quote you?

No. 757. Extra Light Compression, 1 gross Assorted, ¼" to ⅜", ¼" to 2" long, 27 to 20 S.W.G. **15/-** each.

No? Well, it would take all the pages of this magazine—and a lot more—to show in full the immense range of **TERRY'S ASSORTED SPRINGS** in all their variety—compression, expansion, heavy, light, long, short, any gauge you want. But in our **BOXES OF ASSORTED SPRINGS** you'll certainly find the *very* spring you've been looking for. Why not let us send you our full illustrated list of BOXES —post free?



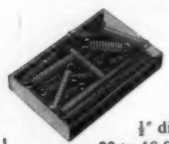
No. 98A. 3 doz. Assorted 1" to 4" long, ⅛" to ¾" diam., 19G to 15G. **5/6** each.

No. 758. Fine Expansion Springs. 1 gross Assorted ⅛" to ⅜", ⅛" to 2" long, 27 to 20 S.W.G. **15/-** each.

TERRY'S ASSORTED SPRINGS

HERBERT TERRY & SONS LTD. REDDITCH, WORCS.
(Makers of quality Springs, Wireforms & Presswork for over 100 years)

No. 388. ½ gross Assorted Small Expansion Springs. ⅛" to 1½", 18G to 21G. **9/6** each.



No. 753. 3 doz. Assorted Light Expansion ⅛" to ⅛" diam., 2" to 6" long, 22 to 18 S.W.G. **10/6** each.

No. 1024. 20 Compression Springs 12" long. ⅛" to ⅛" diam., 24G to 18G, suitable for cutting into shorter lengths; and 30 Expansions 1¼" to 12" long, 5/32" to ⅛" diam. 22G to 16G. **24/-** each.

Interested in Spring Design? Send for "Spring Design and Calculations"—Post free 12/6

No. 760. 3 doz. Assorted Light Compression Springs. 1" to 4" long, 22 to 18 S.W.G., ⅛" to ½" diam. **6/6** each.

HT 23

SWING THIS WAY
FOR EFFECTIVE
POWER CONTROL
ON THAT
DRIVE

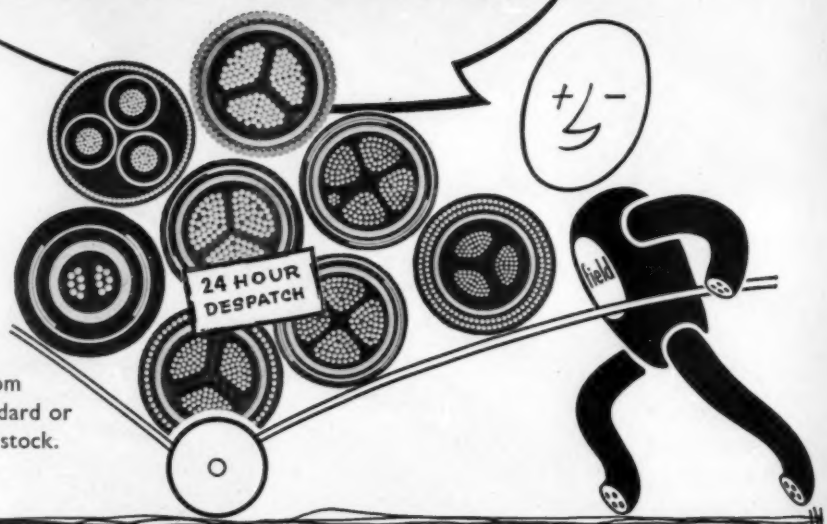
DAI REES, C.B.E. illustrates

AIREDALE ELECTRICAL & MANUFACTURING CO. LTD.
Industrial Electric Motor Control Gear Makers
Head Office and Works: HARROGATE ROAD, APPERLEY BRIDGE, BRADFORD. Telephone: Idle 686
London Office: 225 GRAND BUILDINGS, TRAFALGAR SQUARE, W.C.2. Telephone: TRAfalgar 3559

POWER
DRIVE
CONTROL

LOW TENSION PAPER CABLES

from stock



We are prepared to cut and supply any length you require, no matter how small, either from our standard or sundry stock.

Make sure you receive regular monthly details of our stocks by adding your name and the letters P.C.S.L. to your letter heading and mailing it to our Sales Headquarters. You will then receive a copy of the "Enfield Paper Cables Stock List" each month.

ENFIELD CABLES LIMITED

Sales Headquarters: Victoria House, Southampton Row, W.C.1. Telephone: HOLborn 9292 (10 lines)
Telex No: 23813. Answer Back: ENFIELD LONDON.
Telegrams: Enfelcama London Telex. Cables: Enfelcama London.

If you require *immediate* service, please telephone your nearest Enfield Branch.

ENFIELD SERVICE IS AVAILABLE AT:—

BRANCHES

BELFAST
Telelephone: Belfast 21424/5
Branch Manager: W. S. Mercer.

BIRMINGHAM
Telephone: Calthorpe 3941/2/3
Branch Manager: J. J. Timmins.

BRIGHTON
Telephone: Brighton 25828/9
Branch Manager: B. Smith.

BRISTOL
Telephone: Bristol 24271/2
Branch Manager: G. N. Charters.

CARDIFF
Telephone: Cardiff 21266
Branch Manager: E. Evans.

GLASGOW
Telephone: South 3581/2
Branch Manager: A. B. MacLean.

HULL
Telephone: Hull 35018
Branch Manager: C. Wood.

IPSWICH
Telephone: Ipswich 51314
Branch Manager: C. O. Tompkins.

LEEDS
Telephone: Leeds 32661
Branch Manager: W. F. Tighe.

LONDON
Telephone: Museum 2588
Branch Manager: E. Hupfield.

LUTON
Telephone: Luton 4234
Branch Manager: A. B. Chaplin.

MANCHESTER
Telephone: Central 5074
Acting Branch Manager: J. A. Walker.

NEWCASTLE
Telephone: Newcastle 27208
Branch Manager: F. R. Mackenzie.

NOTTINGHAM
Telephone: Nottingham 45013/4
Branch Manager: R. P. Swinbank, A.I.E.E.

SOUTHAMPTON
Telephone: Southampton 69410
Branch Manager: W. F. Lawrence.

DEPOTS

CANTERBURY
Telephone: Canterbury 3881
Representative: L. F. Stotesbury.

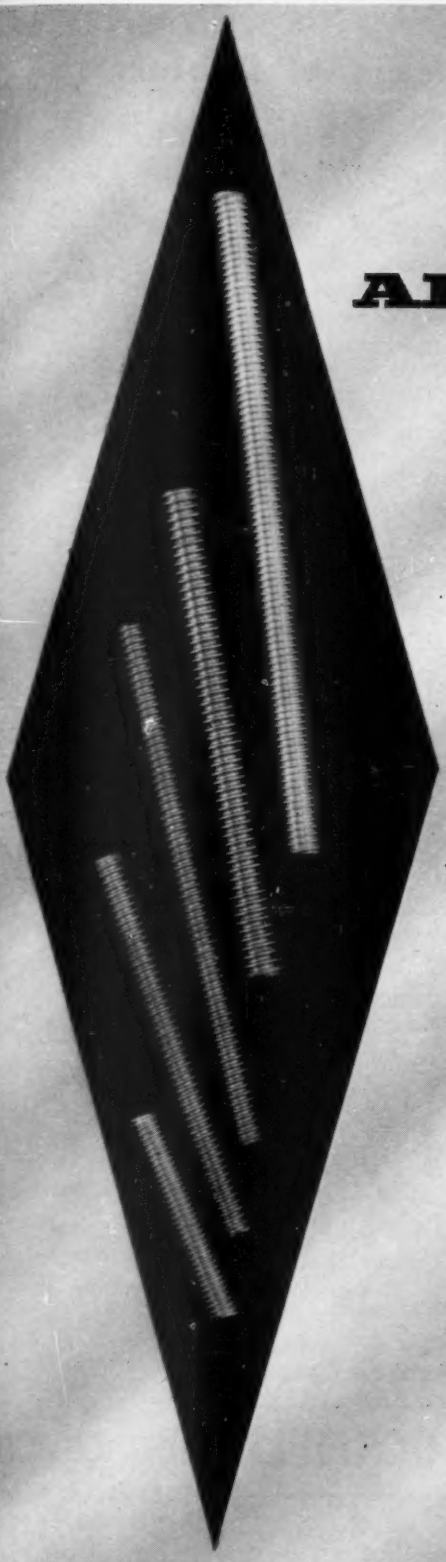
EDINBURGH
Telephone: Caledonian 1597
Representative: J. McDonald.

MIDDLESBROUGH
Telephone Middlesbrough 57220
Representative: J. W. Stirk.

SHEFFIELD
Telephone: Sheffield 20555
Representative: P. Collins.

STOKE
Telephone: Stoke-on-Trent 21310

PC.1



ALL THREADS

ENGINEERING ORMOND COMPANY LTD.

The range, in both Brass and Steel, is from 0.BA to 5 BA and $\frac{5}{16}$ to $\frac{1}{8}$ inch diameter and between $\frac{3}{4}$" and 4" long. Recommended for use within this range, with rolled threads, where studding in these lengths in cut threads would be too expensive. Please send for stock lists.

The Ormond Engineering Co. Ltd.

ORMOND HOUSE, ROSEBERY AVENUE,
LONDON, E.C.1.

Telephone:
TERminus 2888

Telegrams:
"Ormondengi, Smith"

Connect
TO A BETTER STANDARD!

Furnace welded for easier bending. Guaranteed conformity with BS.31. Write for name of your nearest wholesaler.

GEORGE BURN LIMITED

TESTED SUPER STEEL
CONDUIT

GEORGE BURN LIMITED
City Tube & Conduit Mills, Smethwick, Birmingham
Telephone: Smethwick 1511 (5 lines)
LONDON: 2 Deanway, N.2.
LIVERPOOL: 24 Chapel Street, 2.
EDINBURGH: 22 Shandon Place, 11.

dmGB37

Lionel Robinson
& Co. Ltd.

DISTRIBUTORS OF

WOLF ELECTRIC TOOLS

102 Abbey Street Accrington
Accrington 2774

7 Springfield Street Warrington
Warrington 34391/2

161-163 Eldon Street
Preston
Telephone—Preston 57975-6

4 Staple Inn
London, W.C.1
Telephone - - HOLborn 6322

Another ALUMINIUM
REFLECTOR
in the
STOCKFIELD
range

★ *Our SP/1 Reflector spinning in super purity aluminium, electro-brightened to give very high reflectivity.*

Spinners to the Trade

STOCKFIELD MFG. CO. LTD.
23 Stockfield Road
BIRMINGHAM 27

Telephone: Acocks Green 2931

for better cathodic defence -

specify

DAVENSET

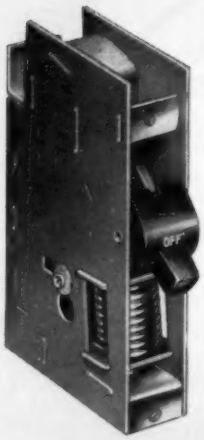
CATHODIC PROTECTION RECTIFIERS

for protecting pipelines and all underground structures ; ships' hulls, jetties and similar marine installations.

An extensive range of DAVENSET oil-filled mains-operated Rectifiers is available to suit every location and type of installation. These rectifiers embody a double-wound vacuum-impregnated transformer and full-wave selenium metal rectifier. These components are sealed in an oil-filled tank. Input and output fuses, control switches, ammeter, volt-meter and cable terminations are mounted in a drip-proof gasket sealed cubicle. Built for rugged outdoor service in all climates.

Field survey by specialist engineers available — for full information write to :—

PARTRIDGE, WILSON & CO. LTD., Davenset Electrical Works • Leicester



"A" Series Range 4·5 to 30 amps. catered for by four interchangeable units combining switching facilities and circuit protection in one unit.

The dolly is trip free, cannot be held on against overload. Your safeguard against sustained overload and fault conditions.

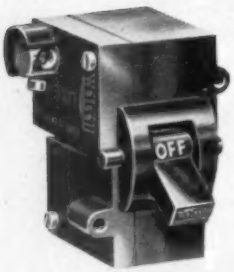
Bring your installation up to date now with the protection of the future. **A.C. only.**

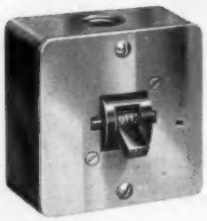
Walsall

Wal-break

MINIATURE CIRCUIT BREAKERS

GIVES COMPLETE PROTECTION TO CIRCUITS & EQUIPMENT





Designed to provide a compact switching unit with overload protection that will fit into a BSS 1299 box. 133 to 750% rating overload protection by means of Bi-metal.

Heavier fault conditions by means of Electro Magnetic overload coil.

Capable of switching against large initial current as Tungsten Lamp loading. **A.C. only.**

WALSALL CONDUITS LTD

EXCELSIOR WORKS · WEST BROMWICH · ENGLAND

Chemical and Petroleum Exhibition

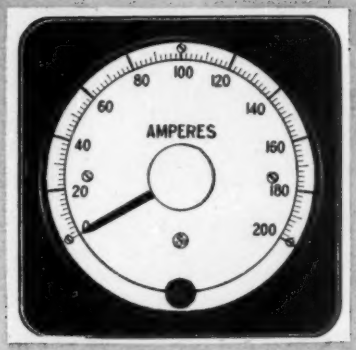
18th to 28th June 1958

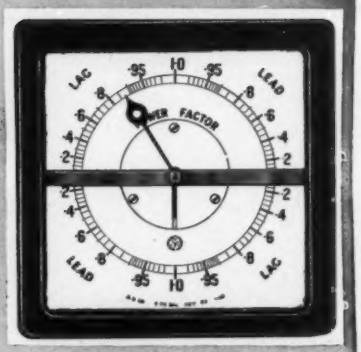
Olympia

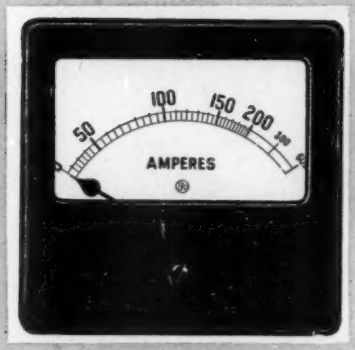
STAND H12

Note the Trade Mark

it's







NALDERS

Nalders Measuring Instruments cover a wide range, high quality being characteristic of every type. Cases are of rectangular, square or round pattern in diecast aluminium or pressed steel, finished bright black stove enamel or other colour as required.

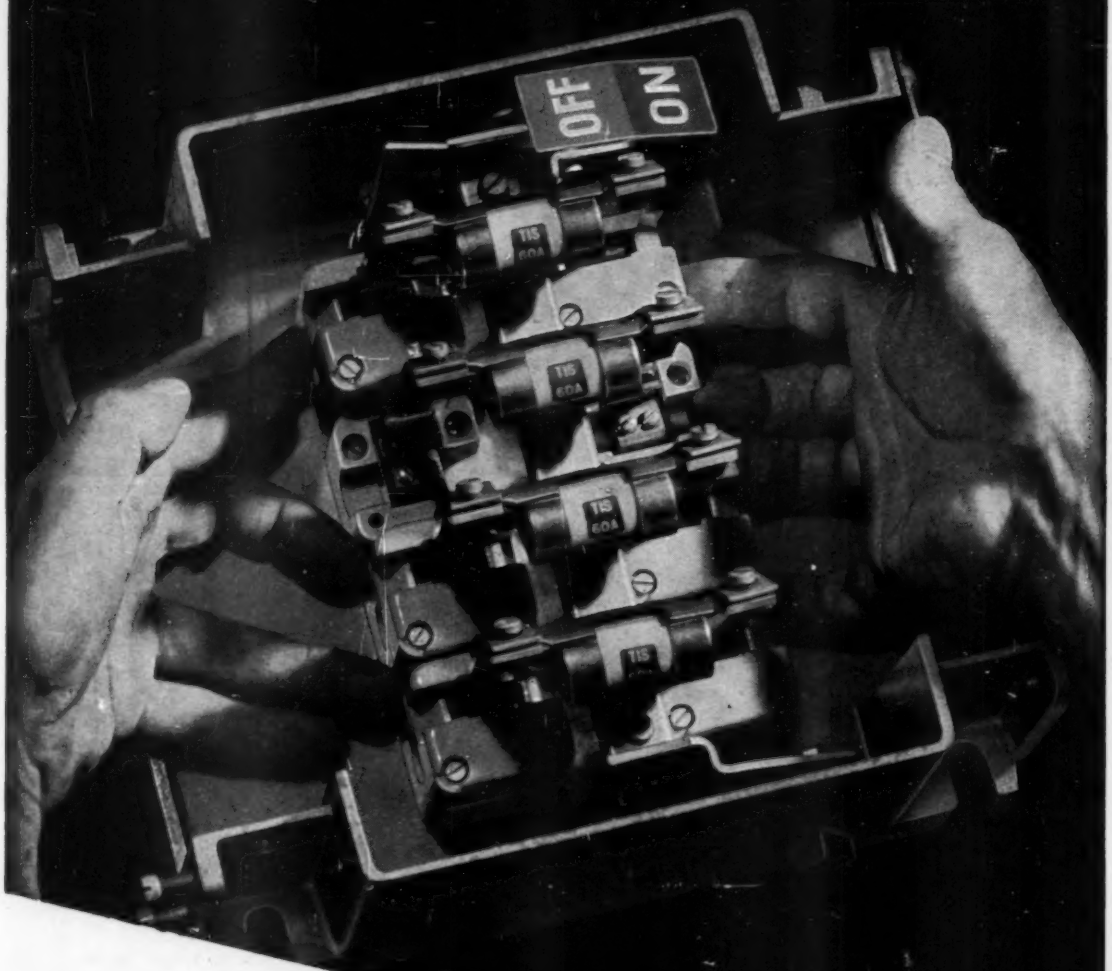
PROMPT DELIVERY

NALDER BROS. & THOMPSON LTD.

DALSTON LANE WORKS
LONDON, E.8

Phone : CLIssold 2365 (4 lines)
Grams : " Occlude Hack London "

everything has to be CONTROLLED



to control electricity

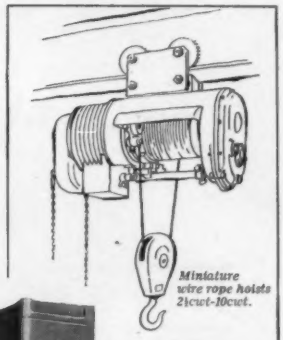
SANDERS

The mark of superiority in Switch and Fusegear

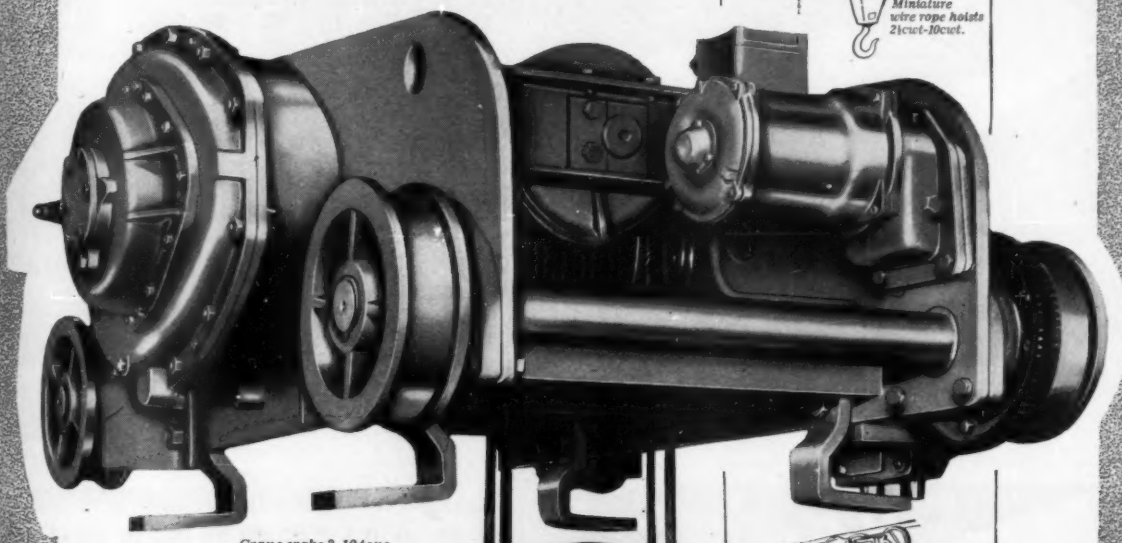
A camera view of the 'Sandaclad' one of the most modern and praiseworthy designs in the Sanders range.

WM. SANDERS & CO. (WEDNESBURY) LTD.
FALCON ELECTRICAL WORKS, WEDNESBURY, STAFFS.

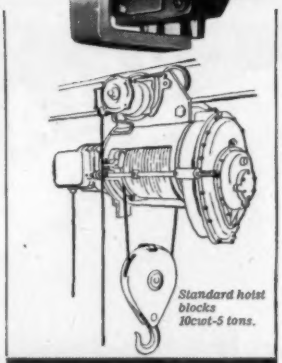
ELECTRIC HOIST BLOCKS AND CRANE CRABS



Miniature wire rope hoists 2½cwt-10cwt.



Crane crabs 3–10 tons.



Standard hoist blocks 10cwt-5 tons.

ASEA

The ASEA range of hoist block equipment covers all general requirements, gives you these features :

- Totally enclosed gearing, brake mechanism, motors, switchgear, etc.
- Built-in brakes, including emergency centrifugal brake to limit lowering overspeed.
- Built to the highest standards throughout.

consult FULLER ELECTRIC

DIAMOND 1898 - 1958 JUBILEE

Sole U.K. representatives for ASEA Sweden.

FULLER ELECTRIC LTD · FULBOURNE ROAD · LONDON E.17

Telephone LARkswood 2350

Also at Birmingham, Glasgow & Manchester

A member of the Hawker Siddeley Group

CELEBRATING

our

DIAMOND JUBILEE

1898 1958

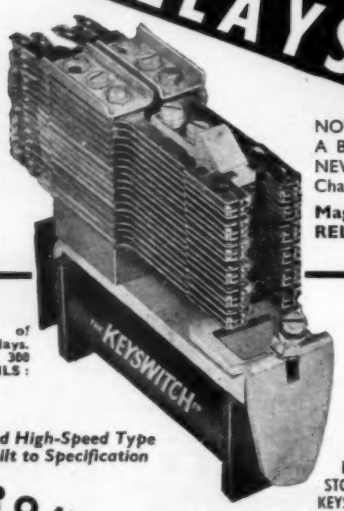
HOFFMANN

BALL AND ROLLER **BEARINGS**

ROLLER BEARING **AXLEBOXES**

THE HOFFMANN MANUFACTURING CO. LTD., CHELMSFORD, ESSEX

RELAYS



NOW! A BRAND NEW 12 Changeover **Magnetic RELAY**

Enormous range of 3,000 P.O. Type Relays. CONTACTS : 300 m/A to 8amp. COILS : Up to 100,000Ω.

P.O. 600 and High-Speed Type Relays. Built to Specification

LARGE STOCKS OF KEYSWITCHES

PROMPT DELIVERY

THE KEYSWITCH CO.

2 Irongate Wharf Rd., Praed St., London, W.2 PAD 3231-2-3

Contractors to Home and Overseas Governments and H.M. Crown Agents

TRANSFORMERS

MANUFACTURED UP TO 500 K.V.A

FOR INDUSTRIAL AND DISTRIBUTION PURPOSES

GOOD DELIVERY AT COMPETITIVE PRICES

Selenium Metal Rectifiers Manufactured Up to 30 K.W.

AUSTIN WALTERS & SON, LTD.,

TRANSFORMER DIVISION

AYRES ROAD, MANCHESTER, 16

Tel: TRAfford Park 1827

CW 3265

PLASTICS
ELO
PRODUCTS

BIRKBYS LTD. LIVERSEDGE, YORKSHIRE

London Office :- 79 Baker Street W.1.

ARCOLECTRIC SIGNAL LAMPS

S.L.78

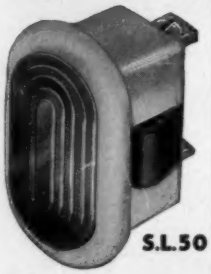
S.L.90/SB

S.L.78: Neon signal lamp for all mains voltages. A miniature low cost mains signal lamp, single $\frac{3}{8}$" hole fixing.

S.L.90/SB: Low voltage signal lamp for M.E.S. bulbs.

S.L.50: Neon signal lamp with snap-in fixing.

S.L.100: Mains voltage signal lamp for 15 watt B.C. pigmy lamps.


S.L.50

S.L.100

Arcolectric signal lamps are used in the latest supersonic military aircraft.

Write for Catalogue 131

ARCOLECTRIC SWITCHES · LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY. Tel.: MOLESEY 4336

Thermalair

HEATING and VENTILATING EQUIPMENTS

3-5kW FAN UNIT HEATER

- All types of space heating equipment supplied
- Safety Switch
- Summer Ventilation
- Accessible for service
- Economical and easy to instal

3 kW Fan Unit Heater £14.10.3 list
5 kW Fan Unit Heater £19. 3.9 list

Specification—

Casing: Aluminium Alloy of high tensile strength.
Elements: High-grade Nickel Chrome. Black Heat, easily replaceable.
Motor: Shaded Pole Single Phase with large bearing surface.
Voltages: 3 kW, 200/250 V, A.C.
5 kW, 346/440 V, A.C.
Finish: Polychromatic Bronze.

H.V.E. (ELECTRIC) LTD.

Viaduct Works, Kirkstall Rd., Leeds 4

Phone: Leeds 29315 (3 lines)

FITTER & POULTON ltd.

TELEPHONE CALTHORPE 1151-2 · TELEGRAMS FAP BIRMINGHAM
VINCENT PARADE · BIRMINGHAM · 12

SM/FP 3883/1

1,100 to 11,000 volts

PAPER INSULATED POWER CABLES

CONNOLLYS

FOUNDER MEMBERS OF THE C.M.A.

Connollys Paper Insulated Cables are serving all fields of industry where voltages from 1,100 to 11,000 are required. Construction conforms with British Standard and C.M.A. Specifications, and the craftsmanship conforms with Connollys tradition of constant progress.

CONNOLLYS (BLACKLEY) LTD

Head Office: **Manchester, 9.** *Telephone:* **CHEetham Hill 1801.** *Telegrams:* **'Connollys' Blackley.**

Branch Offices and Stores:

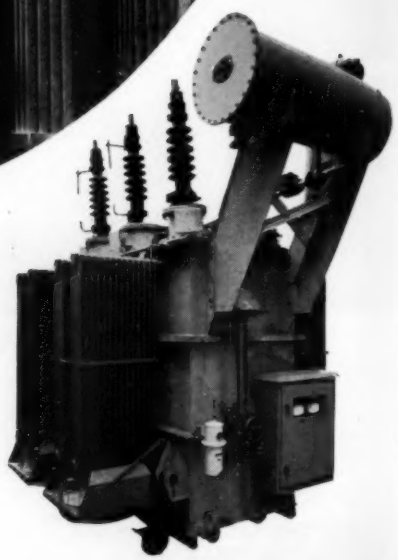
London: 23, Starcross Street, N.W.1. Tel: EUSton 6122. **Birmingham:** 39/44, Watery Lane, Bordesley, Birmingham, 9. Tel: Victoria 4991/2. **Telex:** 33-309. **Glasgow:** 73, Robertson Street, C.2. Tel: CENtral 3662.

dm CL.22

A*

transformers fo

INDIA 7500 kVA 132/33 kV.
transformer for Madras.



CHILE 5000/6250 kVA 66/16 kV transformer.

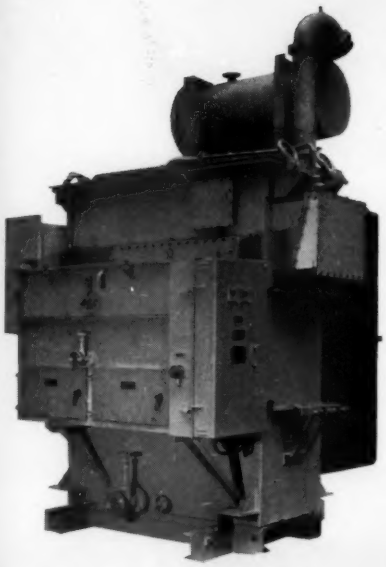
CANADA
on-load tap-

G.E.C. power tra

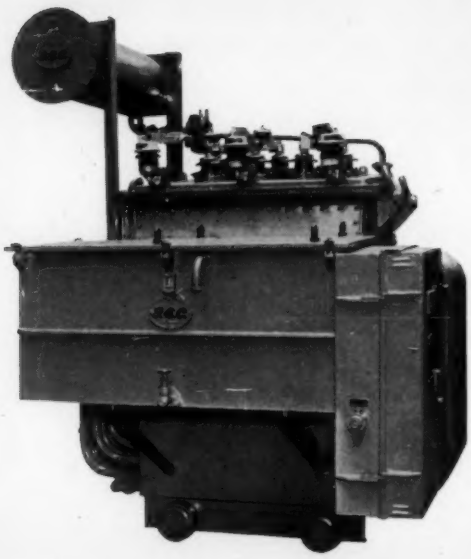
HEAD OFFI

s for the world

In lands as far apart as Canada and Chile — as India and South Africa — G.E.C. transformers are helping to bring the manifold benefits of electric power to the peoples of the globe. For the world has come to rely on the transformer equipment developed, manufactured and installed by the skilled technicians of this great organisation.



CANADA 2500 kVA 13.8/2.4 kV 60 c/s transformer fitted with on-load tap-changing switch for Niagara.



SOUTH AFRICA 2500 kVA 3.3/3.3 kV transformer fitted with on-load tap-changing switch for the Rand mines.

er transmission equipment

AD OFFICE: MAGNET HOUSE KINGSWAY LONDON WC2 · THE GENERAL ELECTRIC COMPANY LIMITED OF ENGLAND.

What do you mean —the acid test?

'Well, the problem here at British Cellophane Ltd., was to provide cabling that would resist the effects of a corrosive atmosphere. The answer—aluminium sheathing with a further sheathing of p.v.c. overall. Top marks to J. & P.'

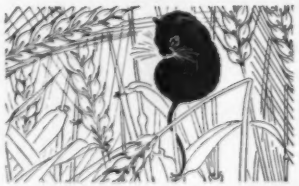
'J. & P.? So this is another Johnson & Phillips job?'

'Yes, we've used 25,000 yards of their cable during the last four years, and no sign of corrosion has appeared. Not bad when you remember that previously all the cables had to be replaced every 18 months.'

'Good for J. & P.!'

'Yes! They have the know-how to simplify most electrical problems.'

J. & P. POWER POINTS



As the country mouse said:

"Corrosion arises in fertiliser manufacture, too." J. & P. overcame this difficulty for Fisons with the same type of cable. If you have an out-of-the-ordinary cabling problem —call in J. & P.!

JOHNSON & PHILLIPS

A Power in the Electrical World

JOHNSON & PHILLIPS LTD · CHARLTON · LONDON · S.E.7

You can't go wrong with Sifbronze!

says Will the Welder

As far as I'm concerned, Sifbronze Welding has one big advantage—its low temperature application. That makes it quicker and easier to use, and I always find it gives the strongest weld.

There are 31 different rods in the S.I.F. range — so you'll always find one for the job in hand. There's no doubt about it—you can't go wrong with Sifbronze!

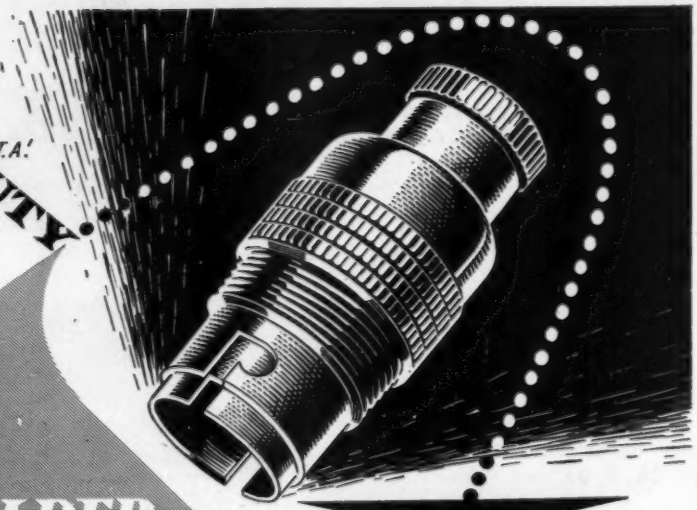
If you're not yet using Sifbronze I recommend you write at once for details to

SUFFOLK IRON FOUNDRY (1920) LTD
Stowmarket, Suffolk
Telephone: Stowmarket 183

HEAVY DUTY

PATENT 'T.A.'

This patent bayonet holder will operate continuously at 10 amps with safety, and will reduce maintenance charges. Specially designed for Railway conditions.



LAMPHOLDER

SPERRYN

SPERRYN & CO. LTD., MOORSOM ST., BIRMINGHAM 6

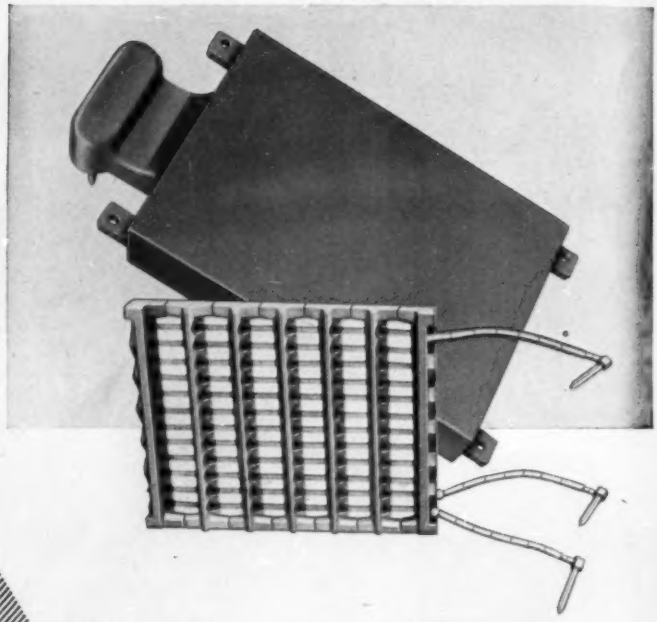
Telephone: ASTon Cross 4011 (5 lines)

LONDON ADDRESS: 23 GREAT SUFFOLK ST., LONDON, S.E.1 TELEPHONE: WATERLOO 6418

GRILLER-BOILER PLATES FOR MODERN COOKERS

TO E.D.A. SPECIFICATION

High grade iron casting. British made ceramic insulators. Best quality 80/20 nickel chromium heating coils. Insulator assemblies available with or without insulated leads and terminal pins.



GENRISTO

The elements of Good Heating

GENRISTO LTD., OSMASTON ST., NOTTINGHAM. Tel.: Nottm. 52148

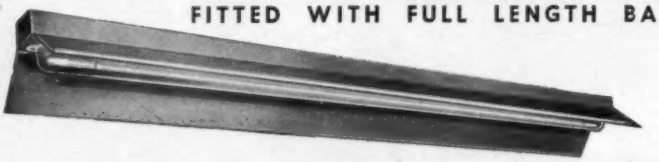
Wholesale only

FOR BETTER LIGHTING

FLUORESCENT **Wafax** FITTINGS

Obtainable in 5, 4 and 2 ft. Single and Twin Models

FITTED WITH FULL LENGTH BACKPLATES



5' OPEN ENDED TROUGH
with Quick Release Covers.
£4.12.0d. List Price
excluding tube.

5' BATTEN
with Quick Release Covers.
£4.0.0d. List Price
excluding tube.

SEND FOR CATALOGUE

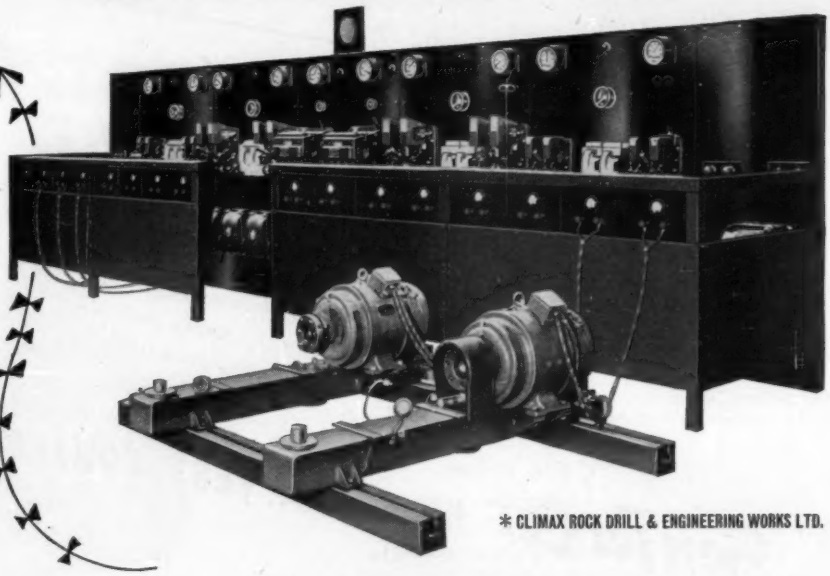
WADES (HALIFAX) LTD. *Arden Works, Fenton Road, Halifax* TEL: 61637

Black Kite at Redruth

*Climax of Redruth, Cornwall, chose black Tufnol panels made from Kite Brand for their heavy duty switchboards.

Tufnol Kite Brand sheet combines high grade electrical insulation with mechanical strength. It has a tensile strength of 20,000 lb. per square inch and to chip it is almost impossible.

Tufnol can be drilled, tapped, routed, sawn or turned with all the normal engineering tools. Write for further information on this modern material.



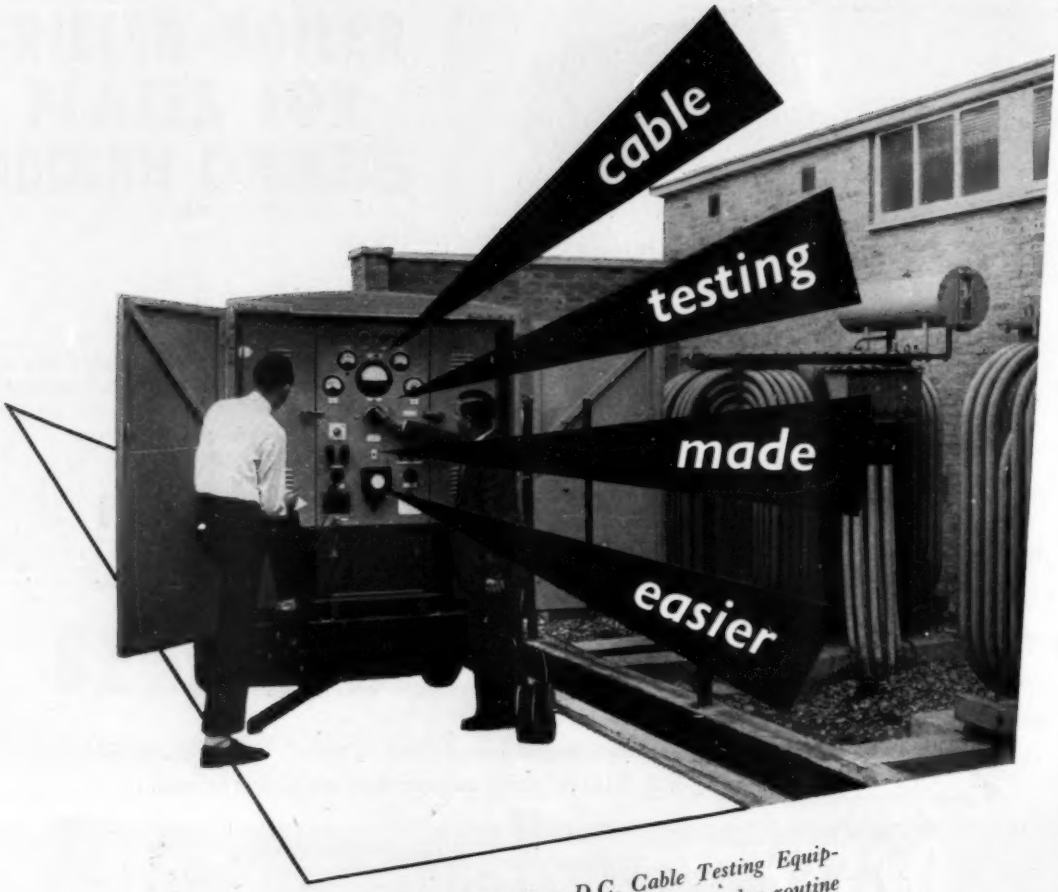
* CLIMAX ROCK DRILL & ENGINEERING WORKS LTD.

TUFNOL

REGISTERED TRADE MARK

An ELLISON Product

TUFNOL LTD., PERRY BARR BIRMINGHAM 22B



SenTerCet *High Voltage D.C. Cable Testing Equipments, portable or transportable, enable regular routine tests to be carried out and provide information which permits a higher level of maintenance, thus ensuring considerably longer cable life.* ***SenTerCet*** *High Voltage D.C. Cable Test Equipments are simple, reliable and robust. Their cost will be recovered in a few years by the pre-detection of deterioration which might lead to failure or, when failure has occurred, by speedy fault location which alone enables repairs to commence without delay.*

SenTerCet HV CABLE TEST EQUIPMENT

SenTerCet RECTIFIER EQUIPMENT

Write for Booklet F/CT.1

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

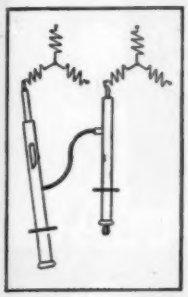
RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

Is It Alive?

'WESTMINSTER' PATENT VACUUM TUBE DETECTORS
WILL SHOW

Visible indication on contact with a live conductor, or in case of high voltages as soon as Detector approaches and before contact is made.

Range 2,000 to 35,000 V.



'WESTMINSTER' PHASING RODS
To locate interconnections between two A.C. systems.

'PARTRIDGE' PRESSURE DETECTORS
Give visible and audible indication of whether lines and contacts of draw-out switchgear are alive or dead.

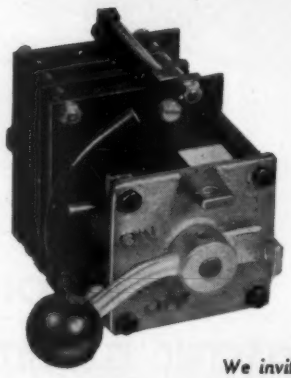
NO EARTH CONNECTION REQUIRED

Write for full details to sole manufacturers:

The WESTMINSTER ENGINEERING Co. Ltd
(Dept. H.1) Victoria Road, Willesden Junction, London N.W.10
Tel. ELGar 7372 (2 lines)

"Colne" ISOLATOR SWITCHES

660 v. 60 ampere capacity A.C. with door interlock mechanism.



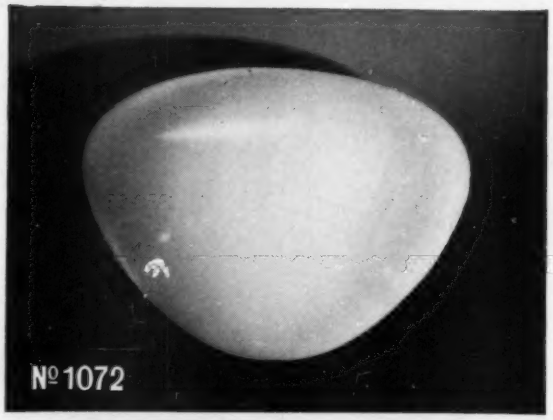
We invite your enquiries

Manufactured by

Colne

SWITCHGEAR (K & W) LTD.
formerly Electrical Products (Colne) Ltd.
Walton Street, Colne, Lancs.
Phone: Colne 1394/5

REAL



NON-CORRODIBLE LIGHT FITTINGS

4 Star Features!

★ ALL PORCELAIN BODY INCORPORATING B.C. LAMPHOLDER—IN ONE PIECE.

★ BODY CAN BE MOUNTED DIRECT TO CEILING, OR TO STANDARD CONDUIT BOX.

★ GLASSWARE OF BRITISH MANUFACTURE. HIGH TRANSMISSION FLASHED OPAL.

★ COMPLETE FITTING IS ENTIRELY DUST-PROOF AND WATERTIGHT.

TWO SIZES! Two sizes of this superb fitting are available at very competitive prices.

No. 1052 60 watt. 9 in. dia. x 6¼ in. overall depth.
No. 1072 100/150 watt. 12 in. dia. x 8⅜ in. overall depth.

REAL

R.E.A.L. *is the registered trade mark of*
ROWLANDS ELECTRICAL ACCESSORIES LTD.
R.E.A.L WORKS, BIRMINGHAM, 18.

ALL PURPOSE SWIVEL FITTINGS
IN TO-DAY'S MOOD

Priced for the popular market

Wired complete with B.C. lampholder

in DUAL TONE COLOURS

Red/White Black/White
Yellow/Black White/Black

Ask for leaflet No. 171 E.R.

C. M. CHURCHOUSE LTD.
CLARENDON CROSS · LONDON · W.11 Tel. PARK 5666/7/8
CMC

WILLIAM ESTD. GEIPEL 1871 LIMITED

CONTROL GEAR
A.C. and D.C.
for all Industrial purposes

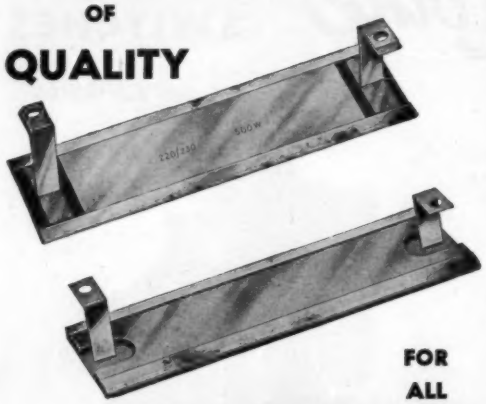
STARTERS
DIRECT ON LINE
PUSH BUTTON
REVERSING
STAR DELTA

REGULATORS
RESISTANCES
RELAYS
CONTACTORS
SWITCHES
ETC.

A full range of Standard Equipment. Special Equipment designed and made to Customers' requirements.

VULCAN WORKS · 156-170 BERMONDSEY ST · LONDON · S.E.1

ELEMENTS
OF
QUALITY

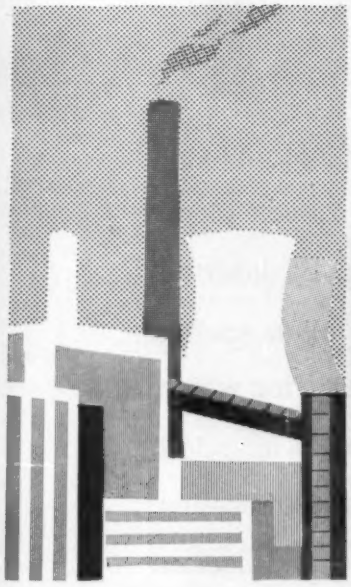


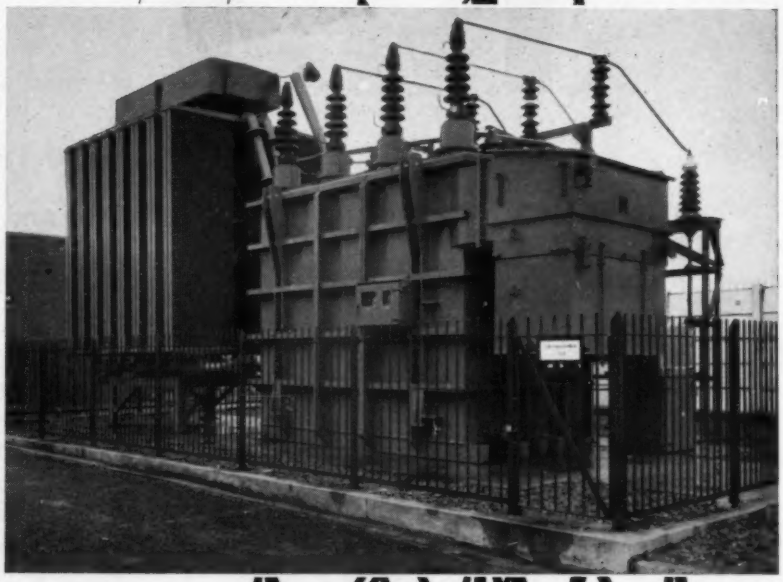
FOR
ALL
WASHBOILERS

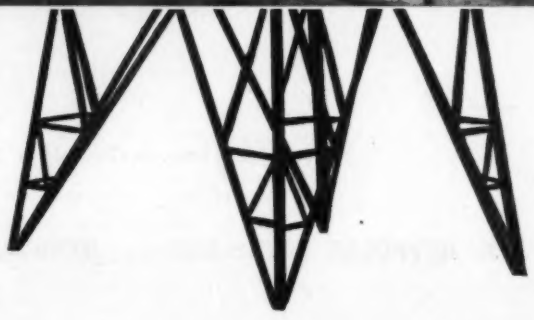
THE ELECTRIC ELEMENTS CO.
Tokenhouse Yard
NOTTINGHAM
Makers of Elements since 1921
Stocked by Leading Wholesalers

YORKSHIRE *transformers*

serve the power supplies of Great Britain

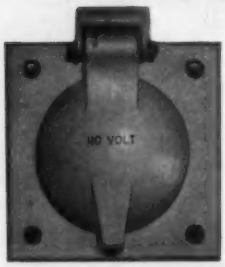






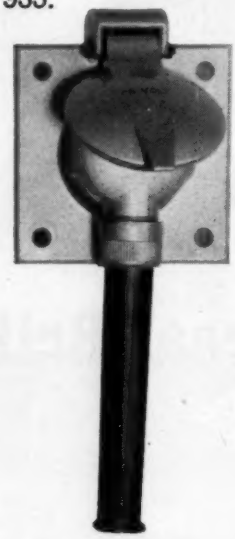
YORKSHIRE ELECTRIC TRANSFORMER CO. LTD.
THORNHILL, DEWSBURY, YORKS., ENGLAND
Tel: Dewsbury 1691-2 Grams: Transforma, Dewsbury

REYROLLE PLUGS AND SOCKETS



Reyrolle plugs and sockets for low-voltage and extra-low-voltage consisting of modified B.S. 196 fittings.

Ask for pamphlet No. 935.



Reyrolle

The 110-volt, 50-volt, and 25-volt plugs cannot be inserted into any other socket than that for which each is intended. The voltage indication on both plug and socket is an optional extra.

Available from distributors shown on opposite page •

A. REYROLLE & CO. LTD. HEBBURN COUNTY DURHAM ENGLAND

REYROLLE PLUGS AND SOCKETS

also in combination with switches and fuses

FOR INDUSTRIAL USE

They are held in stock throughout the country, the main distributing centres being listed below.

BELFAST
ALFRED E. J. HURST LIMITED
8, COLLEGE SQUARE NORTH

BIRKENHEAD
DOWNES & DAVIES LIMITED
94, CHESTER STREET

BIRMINGHAM
DONOVAN ELECTRICAL CO. LIMITED
70-82, GRANVILLE STREET, 1

BRISTOL
*THE SLOAN ELECTRICAL CO. LIMITED
2, JOHN STREET, 1
*SIMPSON, BAKER & CO. LIMITED
22, STOKES CROFT, 1

CAMBRIDGE
FLINDERS WHOLESALE LIMITED
34, BRIDGE STREET

CARDIFF
W. H. STONE & CO. LIMITED
SERVICE HOUSE, 16-17, HILL'S TERRACE

CARLISLE
DOWNES & DAVIES LIMITED
PATERNOSTER ROW

COLCHESTER
FLINDERS WHOLESALE LIMITED
ST. HELENS LANE

CROYDON
*ALLIANCE WHOLESALE LIMITED
CHURCH PATH, NORTH END

DUBLIN
HUGHES & COYLE LIMITED
47, DAWSON STREET

EDINBURGH
*THE SLOAN ELECTRICAL CO. LIMITED
79-85, HANOVER STREET, 2

EXETER
*SIMPSON BAKER & CO. LIMITED
2/4, SMYTHEN STREET

GLASGOW
JOHN T. CARTWRIGHT & SONS LIMITED
195/199, ST. VINCENT STREET, C.2

GRIMSBY
T. BEADLE & CO. LIMITED
368/376, CLEETHORPE ROAD

HULL
T. BEADLE & CO. LIMITED
3, 4, & 5, CASTLE STREET

IPSWICH
FLINDERS WHOLESALE LIMITED
14/20, ST. PETER'S STREET

LEEDS
SCATTERGOOD & JOHNSON LIMITED
31, ST. PAUL'S STREET

LIVERPOOL
DOWNES & DAVIES LIMITED
1-17, STANLEY STREET

LONDON
*THE SLOAN ELECTRICAL CO. LIMITED
East London Depot:
6, ALBANY ROAD, LEYTON, E.10
South-East London Depot:
60-74, MARKET PARADE, RYE LANE, PECKHAM, S.E.15
South-West London Depot:
31-33, BONDWAY, VAUXHALL, S.W.8
West London Depot:
1, CRAVEN ROAD, EALING, W.5
*ALLIANCE WHOLESALE LIMITED
62-63, GREAT RUSSELL STREET, W.C.1

LUTON
*ALLIANCE WHOLESALE LIMITED
15-17, BUTE STREET

MAIDSTONE
*ALLIANCE WHOLESALE LIMITED
4, UPPER STONE STREET

MANCHESTER
DOWNES & DAVIES LIMITED
72, CHAPELTOWN STREET, 1

MIDDLESBROUGH
ARTHUR JONES & CO.
(Electrical Wholesalers) LIMITED
17-25, NORTON STREET

NEWCASTLE-ON-TYNE
BRITISH ELECTRICAL & MANUFACTURING CO. LIMITED
7/13, CLAVERING PLACE, 1

NORWICH
FLINDERS WHOLESALE LIMITED
HAY HILL, HAYMARKET

NOTTINGHAM
THE STEARN ELECTRICAL CO. LIMITED
21, STONEY STREET

SCARBOROUGH
T. BEADLE & CO. LIMITED
39/41, QUEEN STREET

SCUNTHORPE
T. BEADLE & CO. LIMITED
10, HIGH STREET
2, TRAFFORD STREET

SHEFFIELD
JOHN RILEY & SON (Electrical) LIMITED
281 & 283, ATTERCLIFFE COMMON, 9

SOUTHAMPTON
*SIMPSON, BAKER & CO. LIMITED
1, CHAPEL ROAD

SUNDERLAND
BRITISH ELECTRICAL & MANUFACTURING CO. LIMITED
16-17, BRIDGE STREET

TRURO
*THE SLOAN ELECTRICAL CO. LIMITED
28, RIVER STREET

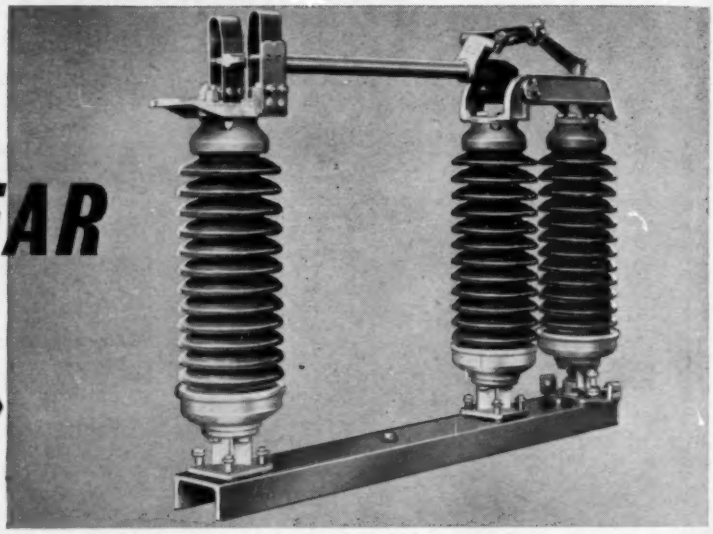
WORKINGTON
DOWNES & DAVIES LIMITED
OXFORD BUILDINGS, OXFORD STREET

YORK
T. BEADLE & CO. LIMITED
PARK STREET, THE MOUNT

**Members of the Edmundson's Group of Companies*

A. REYROLLE & CO. LTD · HEBBURN · COUNTY DURHAM · ENGLAND

H.V. OUTDOOR OVERHEAD LINE SWITCHGEAR



Hackbridge and Hewittic H.V. outdoor overhead line switchgear embodies modern design features ensuring the most dependable performance under all weather conditions.

The range includes:—

Vertical break free entry rotating blade isolators (type RVB) up to 132 kV.

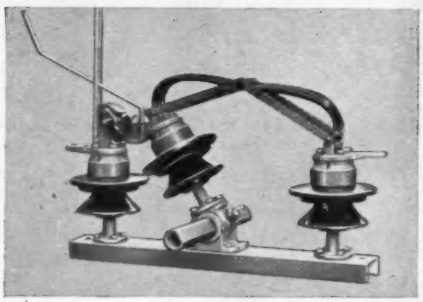
Tilting type isolators (type T) up to 66 kV

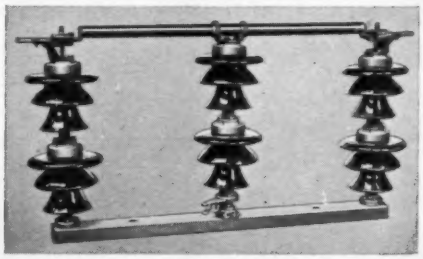
Double break rotating isolators (type RDB) up to 132 kV

Single break rotating isolators (type RSB) up to 66 kV

Current ratings up to 2,000 amps.

Illustrated: *top*, type RVB; *centre*, type T; *and bottom*, type RDB.





HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LTD

HERSHAM · WALTON-ON-THAMES · SURREY

Telephone: Walton-on-Thames 760 (8 lines) Telegrams & Cables: "Electric" Walton-on-Thames

TRANSFORMERS · RECTIFIERS · LINE GEAR

OVERSEAS REPRESENTATIVES.—**ARGENTINA** H. A. Roberts & Cia., S.R.L., Buenos Aires. **AUSTRALIA** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria; N.S.W., Queensland, W. Australia: Elder, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BELGIUM AND LUXEMBOURG** M. Dorfman, 5 Avenue des Phalenes, Brussels. **BRAZIL** Oscar G. Mors, Sao Paulo. **BURMA** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON** Envee Eez Ltd., Colombo. **CHILE** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA** Gerald Hoe (Lighting) Ltd., Nairobi. **EGYPT** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND** Sähkö-ja Konelíike O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE** Glyndova Ltd. **NETHERLANDS** J. Kater E.I., Ouderkerk a.d. Amstel, Amsteldijk Noord 103c. **INDIA** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras 1. **IRAQ** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO** Harper, Gilfillan & Co. Ltd., Kuala Lumpur. **NEW ZEALAND** Richardson, McCabe & Co. Ltd., Wellington, etc. **SOUTH AFRICA** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO** Thomas Peake & Co., Port of Spain. **TURKEY** Dr. H. Salim öker, Ankara. **U.S.A.** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA** Oficina de Ingenieria, Sociedad Anonima, Caracas.

QUICKEST
AND MOST EFFICIENT
method of installing
ELECTRIC CABLES AND WIRES

'HARCO' Perforated Mild Steel Cable Trays are the most rapid and efficient method of fixing electric wires and cables. They save wiring costs because no drilling is required. Standard widths from 2 inches up to 36 inches. Any length up to 10 ft. with BENDS for all standard widths. Write for Folder No. EL 1003.

'HARCO' CABLE TRAYS

Harvey

G. A. HARVEY & CO. (LONDON) LTD.

Woolwich Rd., London, S.E.7. Greenwich 3232 (22 lines)

METER BOARDS all over the world

... and in all climates

Our varied city and outback climates make Wootton Meter Boards the best choice. The pommies make it from quality plywood that's real dinkum. Easily fixed—gives me time for a cuppa !

WOOTTON

wood blocks, sunk switch boxes, instrument cases

WOOTTON & CO. LTD · ALMA WORKS · PONDERS END · MIDDLESEX · *Tel.: Howard* 1858

Cryselco – at your service everywhere

BEDFORD THE BRIDGE In town or country, wherever you are, CRYSELCO'S national coverage ensures for you the best quality and prompt service for all your lamp and fittings requirements. There are branches waiting to serve you in fourteen towns and cities. Please write or telephone.

OVER SIXTY YEARS OF QUALITY AND SERVICE

CRYSELCO

MADE IN ENGLAND

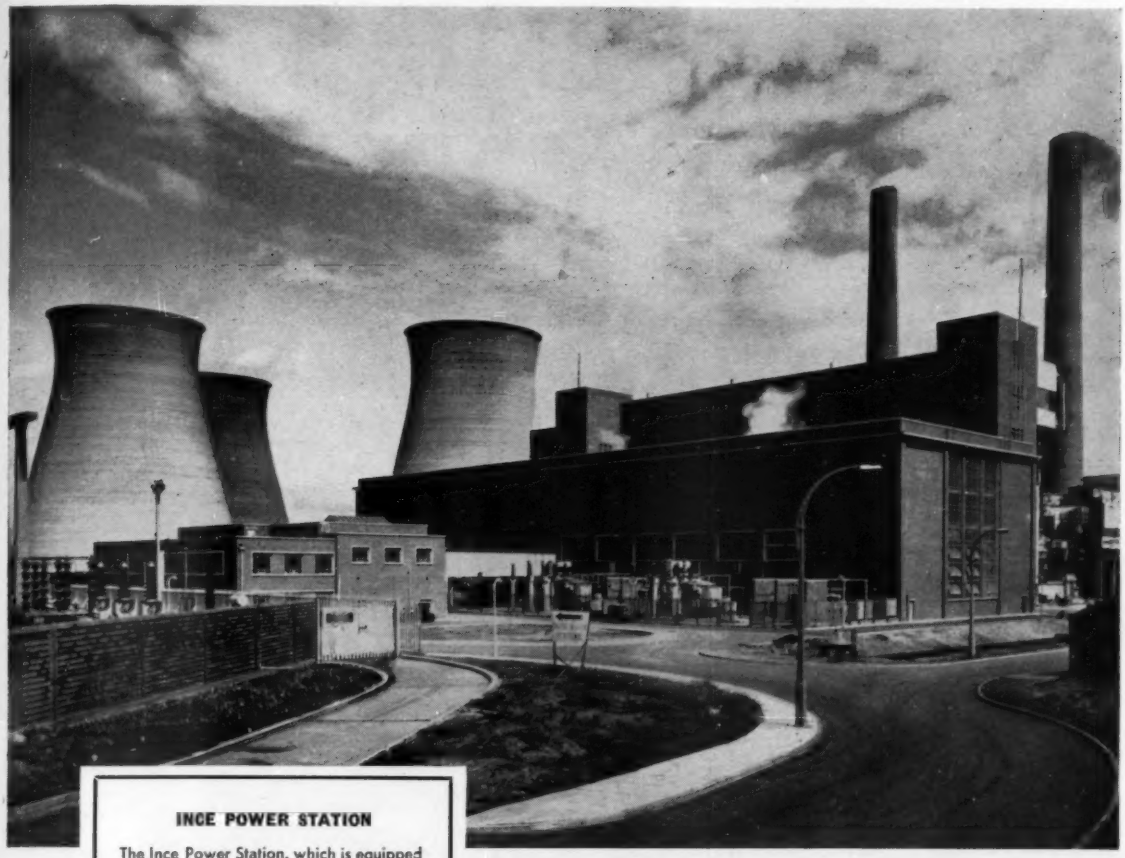
Lamps FOR ALL PURPOSES

OUR ILLUMINATING ENGINEERING DEPARTMENT
IS AVAILABLE TO GIVE CUSTOMERS PROMPT HELP AND SERVICE

QUALITY The foundation of CRYSELCO SALES

Branches BIRMINGHAM · BRISTOL · BURY ST EDMUNDS · CARDIFF · GLASGOW · LEEDS
LEICESTER · LIVERPOOL · LONDON · MANCHESTER · NEWCASTLE · NOTTINGHAM · SOUTHAMPTON

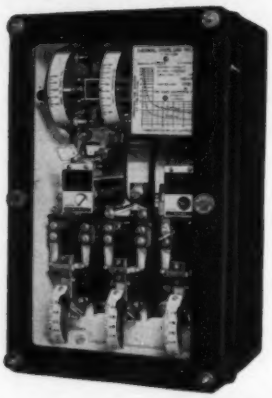
CRYSELCO LIMITED KEMPSTON WORKS BEDFORD



INCE POWER STATION

The Ince Power Station, which is equipped to burn heavy fuel oil as an alternative to pulverised coal, is the first in this country with boilers of semi-outdoor construction. The motors driving the auxiliaries are protected by P & B Golds relays in this and many other power stations of the Central Electricity Generating Board

C·E·G·B chose P & B Golds Protection

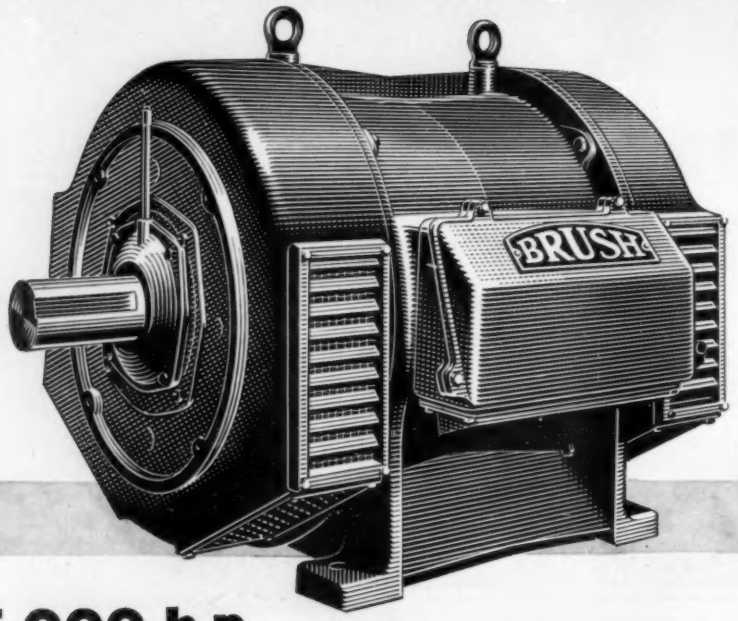


P & B Relays give full protection for motors with any starting periods or currents under extremes of ambient temperature.
P & B Golds Relays protect against phase failure, overload, short circuit or earth fault.
P & B Stalling Relays give complete protection against stalling under all conditions. Send for current literature.

P & B
PROTECTION RELAYS

THE P & B ENGINEERING CO. LTD
CROMPTON WAY
CRAWLEY · SUSSEX
Telephone Crawley 1004

The logical choice in **ELECTRIC MOTORS**



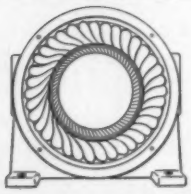
Up to **5,000 h.p.**

Years of trouble-free service from Brush Electric Motors is proof of the practical wisdom and first class workmanship which distinguishes Brush products the world over. No better motors than Brush ever came out of any works.

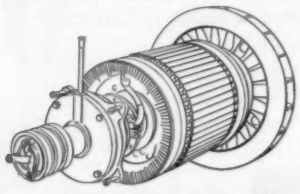
To supply the power drive of industry, Brush offer a range of quality built AC motors with all types of enclosures and standard speeds, for horizontal or vertical mounting.

DC motors are also available with similar outputs.

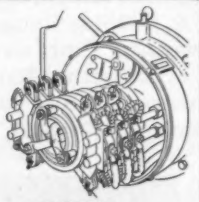
If you require motors within this range, just write to BRUSH stating your particular need —our technical engineers are at your service without obligation.



RIGID FRAME & WINDINGS



SLIPRING ROTOR ASSEMBLY



SLIPRING CONSTRUCTION

BRUSH — *for quality*

Literature G and stocklists available on application

BRUSH ELECTRICAL ENGINEERING CO · LTD

Loughborough · England (Member of the Hawker Siddeley Group)

E. I.

For increased efficiency . . . .

put it on Flexello Castors

'Putting it on castors' is certainly the way to speed things up, and to an amazing extent when the right castors are used for the job. The varied uses of Flexello castors are virtually limitless. They are used in nurseries and steel mills, aircraft plants and beauty parlours. Flexello has the range, the service and facilities to make castors the true servant of the production manager, the hospital matron, the restaurant manager or the storekeeper. Closest inspection, superior design and up-to-date production methods have made Flexello the largest castor manufacturer in Europe.

Flexello

CONSTANT QUALITY
CASTORS

Only a very small section of our range is shown here. Please send for catalogue No. 156 ER or a technical representative for industrial advice.

FLEXELLO CASTORS & WHEELS Ltd., SLOUGH, BUCKS Tel.: Slough 24121

AUTOMATIC VOLTAGE REGULATORS

for

A.C. & D.C. GENERATORS

and for

EXCESSIVE VOLTAGE VARIATIONS ON A.C. SUPPLY SYSTEMS

All types accurate to ± 1%
Self-contained for simple installation
Negligible maintenance

Send details of your voltage problems to the Voltage Regulator specialists:—

COX-WALKERS LTD.

NORTH-EASTERN ELECTRIC WORKS
FEETHAMS - - DARLINGTON

EST. 1880 PHONE 2387

MEASURING INSTRUMENTS

IMMEDIATE DELIVERY

Most Basic Ranges available **ex-stock** for immediate despatch
Special ranges—delivery 7/14 days

Round, Square or Rectangular patterns available, also full range of Industrial Switchboard Instruments. Portable and Laboratory Instruments, Moving Coil, Moving Iron, Thermo Couple, Electrostatic.
We can supply Meters with Non-Standard Ranges in Current, Volts or Ohms. To B.S. 89. Industrial or Precision Grade accuracy.

We are the largest stockists of Electrical Measuring Instruments in the Country.

NEW MINIATURISED MODEL

Turner Model 703
Rectangular Flush 4" x 3", body diameter 2½", scale length 3¼" nominal

Stockists of Meters by
Turner, Weston, Baldwin, E.A.C., Weir and other leading manufacturers

Clients are invited to inspect the display of instruments at our New Offices and Showrooms

ELECTRONIC EQUIPMENT AND TEST APPARATUS MANUFACTURED TO CUSTOMERS' DESIGN OR SPECIFICATION

May we quote for your requirements?

ANDERS ELECTRONICS LTD.

103 HAMPSTEAD ROAD, LONDON, N.W.1
Telephone: EUSton 1639
Contractors to G.P.O. and other Government Departments

first class cables for first class installations

If you want first class cables, backed by a first class delivery service and absolute dependability, Liverpool Cables are your answer.

make sure with **LIVERPOOL CABLES**

THE LIVERPOOL ELECTRIC CABLE COMPANY LIMITED

LINACRE LANE · BOOTLE · LIVERPOOL 20

Certification Mark

PUSHBUTTONS

Smartly engineered, in minimum size, ruggedly built, simple to mount and connect, these modern pushbutton units not only look better but will prove their worth in more reliable, more trouble-free operation—longer.

INDICATING LIGHTS

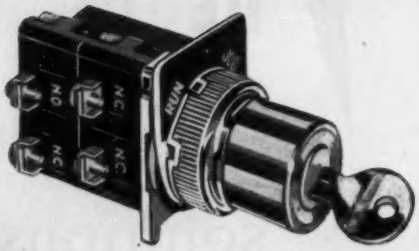
Designed in two styles—the exclusive Pres Test with its built-in testing feature and the standard—both in resistor and transformer types, both compactly designed to match the space-saving feature of the entire line.

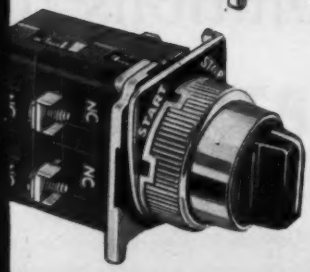
SELECTOR SWITCHES

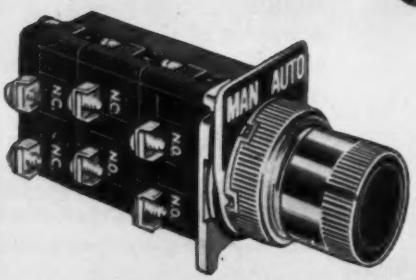
Using the same ingenious and compact contact block as the pushbutton units—include knob and key types. The multiplicity of circuit combinations obtainable is almost unlimited.

Full particulars from Publicity Department, Bedford

an infinite number of combinations

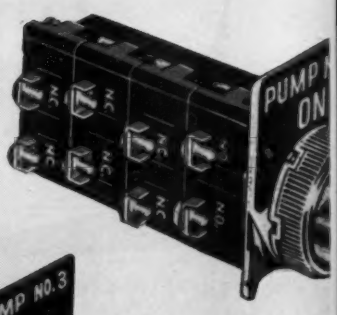


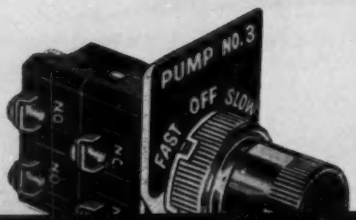




IGRANIC

heavy duty oil-tight control units





IGRANIC ELECTRIC CO LTD

head office and works Bedford

LONDON & EXPORT OFFICE VICTORIA STATION HOUSE 191 VICTORIA STREET SW1

A METAL INDUSTRIES M GROUP COMPANY

DISTRICT OFFICES: BIRMINGHAM BRISTOL CARDIFF EAST ANGLIA
GLASGOW LEEDS MANCHESTER NEWCASTLE SHEFFIELD

DEUCE DIGITAL COMPUTERS

for the fastest

solutions to

OPTIMISATION PROBLEMS

The speed of operation of DEUCE, together with its unrivalled library of programmes and sub-routines, makes possible the quickest solutions of problems which traditionally have taken teams of experts countless hours even to approximate.

All conventional network studies and also special optimisation investigations in system planning and inter-connected networks are among the power system problems which have been solved by DEUCE.

A number of statistical, linear programming and operational research types of investigation have also been carried out.

'ENGLISH ELECTRIC' *also design and build special purpose digital computers, analogue equipments and simulators for specific technical and industrial applications.*

'ENGLISH ELECTRIC'

computer division

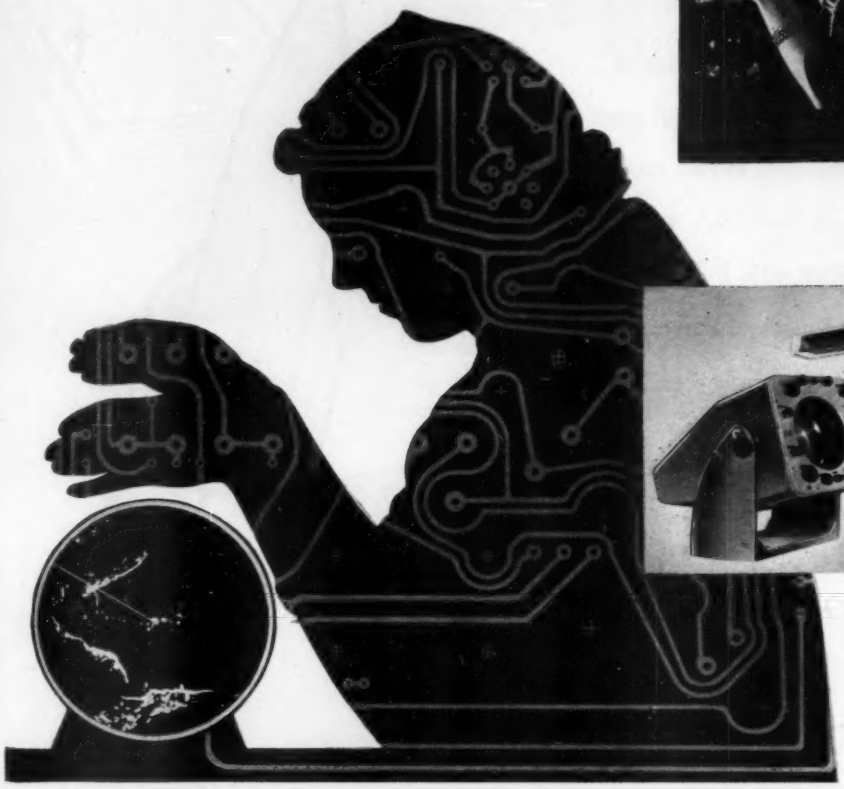
THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.

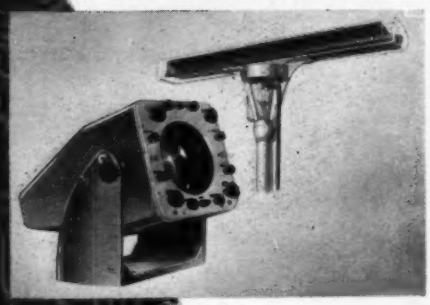
Computer Division, Kidsgrove, Stoke-on-Trent, Staffs. Tel: Kidsgrove 2141/3

WORKS: STAFFORD · PRESTON · RUGBY BRADFORD · LIVERPOOL · ACCRINGTON

BDC.9C9

RADIO FORESIGHT-





with BAKELITE Copper-Clad Laminated

TRADE MARK

The problem of fitting high performance Radar into a compact and lightweight unit suitable for almost any ship has been successfully solved in the Kelvin Hughes type 14 Marine Radar. An important contribution is the extensive use in the Power and Display units of printed circuits produced from BAKELITE Copper-Clad Laminated Materials.

Today printed circuits on BAKELITE Copper-Clad Laminated Materials, either rigid or flexible, are finding new applications throughout the Radio and Electronics industries. They allow more freedom and precision to the designer, reduce production time and costs for the manufacturer, and give the customer a lighter, more compact and reliable instrument.

Write today for a copy of "Copper-Clad BAKELITE Laminated for Printed Circuits".

BAKELITE LIMITED

REGD.

12-18 GROSVENOR GARDENS · LONDON SW1 · SLOane 0898

Bakelite Limited manufacture an extensive range of plastics materials and maintain a technical service unequalled in the industry. No matter what your plastics problems, this service is at your disposal. SLOane 0898 is the telephone number.

YGA 1P1/3

Immediate delivery . . .

In addition to supplying cables of
every description to all parts
of the world we have in fact supplied
cables to the U.S.A. and to the U.K.
in connection with Intercontinental
and Intermediate Range Ballistic Missiles

WANDLESIDE CABLES *for every purpose*

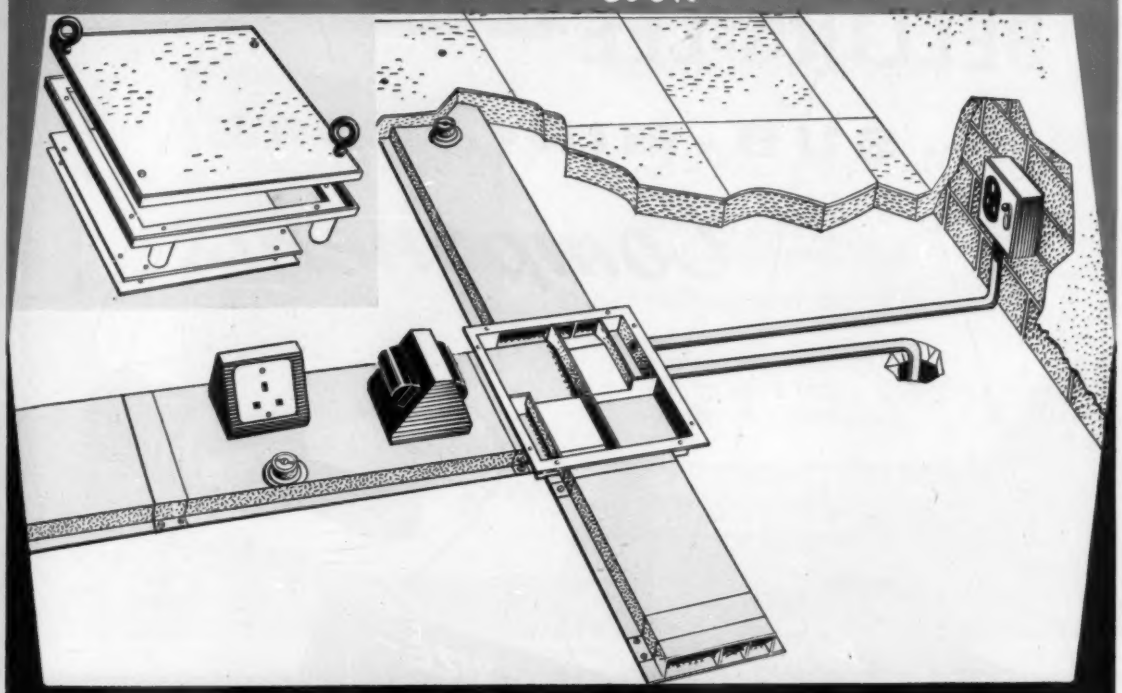
WANDLESIDE CABLE WORKS LTD. 106 GARRATT LANE WANDSWORTH LONDON SW18

One of FALKS Group

Telephone: BATtersea 2273 (5 lines) Telegrams: Wandleside, London

THE IMPROVED

Greenwood-Airvac UNDER FLOOR Duct System



provides for all cables to be accommodated in one duct with adequate screening between telephone and power cables

LATEST DEVELOPMENTS

- Remote adjustable floor frame in brass with recessed lid to take final floor finish.
- Waterproof Junction Box.
- Ducting fitted with adjustable outlets.
- Universal pedestal unit suitable for Post Office or internal telephones, power and lighting.

Please write for further details and information about the Greenwood-Airvac Underfloor and Skirting Duct Systems or call to see the demonstration layouts in the Beacon House showroom.

Greenwood-Airvac *conduit systems*

GREENWOOD'S AND AIRVAC VENTILATING COMPANY LTD

Patentees, Designers and Manufacturers of Ventilating Equipment and Electrical Conduit Systems

BEACON HOUSE, KINGSWAY, LONDON W.C.2. CHAncery 8135 (4 lines). 'Grams 'Airvac', London

"BELLING-LEE"

SUB-MINIATURE

Components

These sub-miniature coaxial plugs and sockets have been designed to meet the mounting requirements for small coaxial connectors brought about by the increase in the development and use of miniaturized equipment.

The plugs are securely retained by a knurled nut which screws on to a thread on the socket. A rubber washer is fitted at the junction of this thread with the fixing flange, to prevent loosening of the knurled nut by vibration.

P.T.F.E. (poly tetrafluorethylene) insulation is used, ensuring low high-frequency losses, and a high maximum working temperature.

All contact surfaces are gold-plated for low resistance connection and to prevent corrosion on the centre pin, where the contact area is fairly small.

The plugs are suitable for use with coaxial cable having outside diameter of $\frac{1}{8}$" approx. (e.g. 50 ohm sub-miniature coaxial cable B.I.C.C., No. R.P.C. 1373).

Weights: L.1403/FP. 1 gm. approx. L.1403/BS. 1.5 gms. approx. L.1403/CS. 1.5 gms. approx. L.1403/RFP. 2 gms. approx.

These components and other new developments are fully described in the Supplement to our General Catalogue: copies are available on request.

ACTUAL SIZE

L.1403/FP. FREE PLUG. The cable to this plug enters along the axis of the plug. The rubber cover protects the cable clamp from damage and gives the plug a streamlined appearance.

L.1403/RFP. RIGHT-ANGLE ENTRY FREE PLUG. This plug has the cable entry at right-angles to the axis of the plug, enabling the cables to be "dressed-down" against a panel without the danger of sharp bends causing cable failure.

L.1403/BS. BULKHEAD ADAPTOR. This socket-to-socket panel mounting adaptor provides for the passage of a coaxial cable through a panel, in such a way that the cable can be disconnected on either side. It is ideal for use where a coaxial lead needs to be continued behind the main panel of equipment.

L.1403/CS. CHASSIS MOUNTING SOCKET. This socket is designed for use where the feeder enters equipment, and is not required to continue as a coaxial cable, as the components associated with it are in close proximity to the socket. It is fitted with soldering tags which are gold-plated for ease of soldering.

BELLING & LEE LTD

GREAT CAMBRIDGE ROAD, ENFIELD, MIDDX., ENGLAND

Telephone: Enfield 3322 · Telegrams: Radiobel, Enfield

Field & Grant
LIMITED

ELECTRICAL
AND REMOTE
CONTROL EQUIPMENT

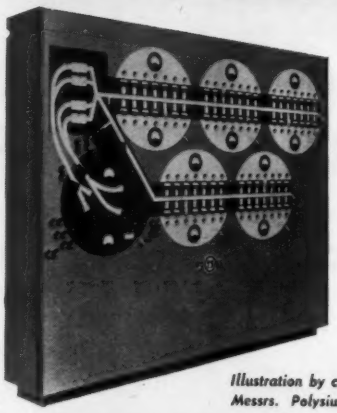


Illustration by courtesy of Messrs. Polysius Limited

Tailor made to YOUR specification or engineered and designed for YOU

★ LET OUR ENGINEERS HELP TO SOLVE YOUR CONTROL PROBLEMS

Get to know us at—

KENT STREET.
BIRMINGHAM 5.

Telephones: MIDLAND 5675-6
LONDON. HARROW 5578

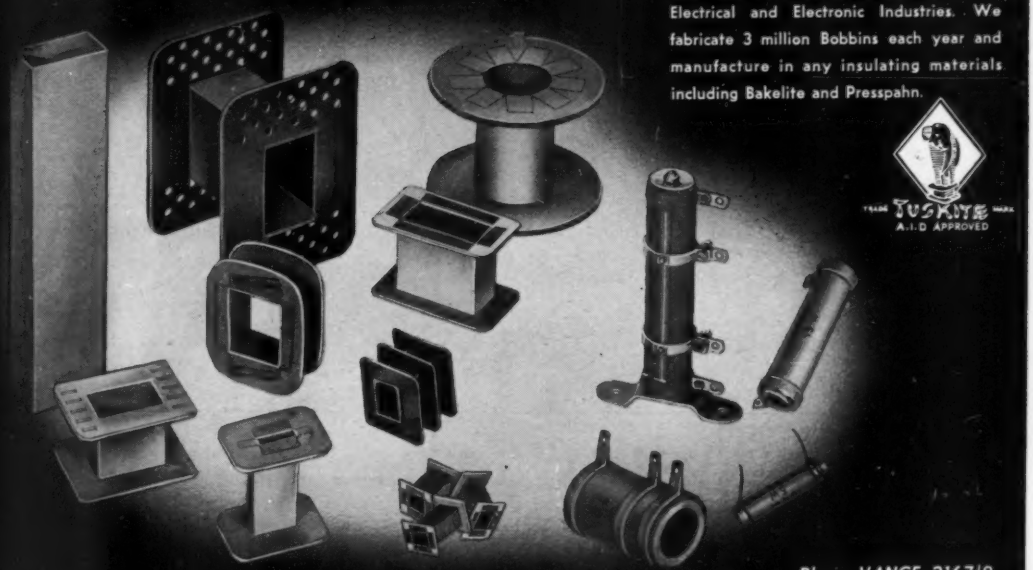
Field & Grant
BIRMINGHAM

The mark of the Specialists

Specialists in insulating **FORMERS, BOBBINS,** *and wire wound* **RESISTORS**

25 Years experience of manufacturing Bobbins and Formers enables us to satisfy the most exacting requirements of the Electrical and Electronic Industries. We fabricate 3 million Bobbins each year and manufacture in any insulating materials including Bakelite and Presspahn.

TUSKITE
A.I.D APPROVED



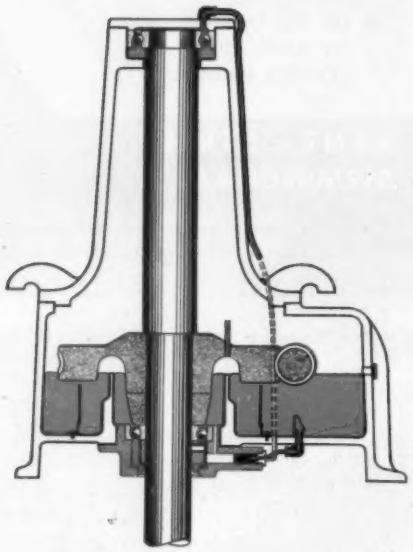
Phone VANGE 2167/8

ARMAND TAYLOR & CO. LTD. TUSKITE WORKS, MARSH ROAD, PITSEA, ESSEX.

gearb

CROFTS MAKE THE

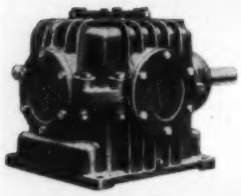
CROFTS AGITATOR TYPE VERTICAL WORM REDUCTION GEARS



3½" to 20" centres; powers up 275 h.p. ratios up to 100 : 1

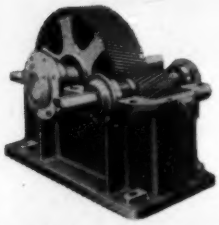
Publications 522 and 5735

- specially designed for agitator and mixer drives
- a range with pressure-lubricated upper bearings as illustrated
- also made as complete worm geared motors



Spiral bevel gear units

Publication 549



Single helical gear units

Send us your enquiries

CROFTS (ENGINEERS) LIMITED

POWER TRANSMISSION ENGINEERS

Head Office: Thornbury Bradford 3 Yorkshire

Telephone: 65251 (20 lines) Telegrams: "Crofters Bradford Telex" Telex 51186

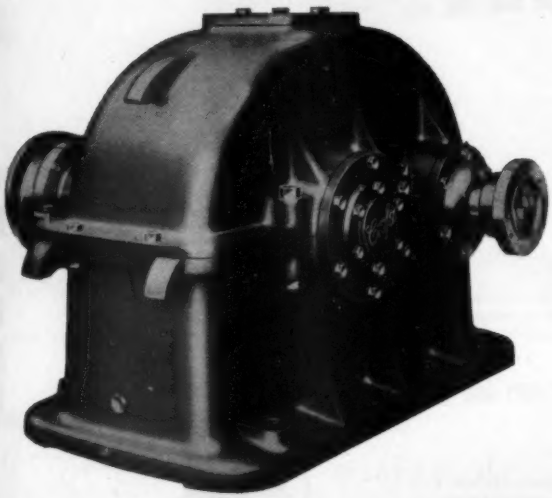
Branches at:
Belfast, Birmingham, Bristol, Cardiff, Dublin, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Northampton, Nottingham, Sheffield, Stoke-on-Trent.

Representation throughout the World

oxes

FINEST YOU CAN BUY

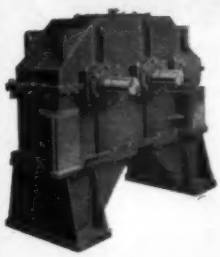
CROFTS DOUBLE HELICAL GEAR UNITS



fractional to 3250 h.p.; ratios up to 50 : 1

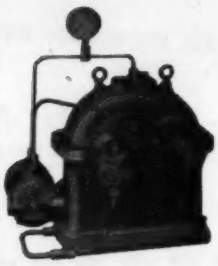
Publication 535

- a high quality heavy duty reduction gear
- standard and high ratio single reduction units; double reduction units also with coaxial input and output shafts
- special units for larger powers or with special gear combinations made to order



special fabricated gear units

all types for every duty



medium power turbine gears

publication 5327

Makers of:

Clutches, Conveyor Drives, Couplings of all types, Double Helical Gear Units, Fabricated Steelwork, Geared Motors, Hydraulic Couplings, Iron, Steel and Non-ferrous castings, Machine-cut Gears of all types, Motorized Rollers, Patent Taper-flushbushes, Plummer Blocks, Shaft-mounted Gear Units, Special Machinery Drives, Spiral Bevel Gear Units, Turbine Gears, V-rope Drives, Variable Speed Drives, Worm Reduction Gears.

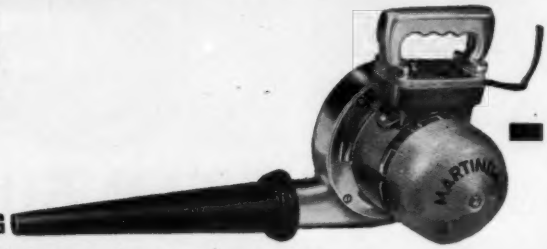
CROFTS (ENGINEERS) LIMITED

POWER TRANSMISSION ENGINEERS

Head Office: Thornbury Bradford 3 Yorkshire

Telephone: 65251 (20 lines) Telegrams: "Crofters Bradford Telex" Telex 51186

The NEW MARTINDALE Portable BLOWERS



POWERFUL BLOWING

The powerful Martindale Blowers direct a stream of dust-removing air into every inaccessible crevice of electrical and other machinery, thus removing a common cause of short circuits and motor failures.

EFFICIENT SUCTION

All of the five blowers are instantly converted into portable industrial suction cleaners by the use of standard attachments at little cost.

HOT AIR DRYING

An independent Heater is available for attachment to the Blowers, which produces hot air for the quick drying of coils, transformers and for many other purposes.

THE "PORT-A-VAC" (regd.)

The "Port-A-Vac" (regd.) light-weight harness permits the Martindale Blower to be used as a powerful vacuum cleaner carried in comfort upon the operator's back leaving him free to climb ladders, etc., to clean out-of-reach parts of the factory.

"MARTINET" WET-DRY SUCTION PICK UP

With this amazing equipment any Martindale Blower is converted into a suction cleaner which picks up both *liquids* and *solids*, the liquids and dirt being deposited into the special tank and only the airborne dust into the filter bag.

For full details of Specifications of Martindale Maintenance Equipment write to:—

MARTINDALE ELECTRIC CO. LIMITED

4 Westmorland Rd., London, N.W.9. COLindale 8642 also at 25 Elmbank St. GLASGOW C.2.

M.G.Y.

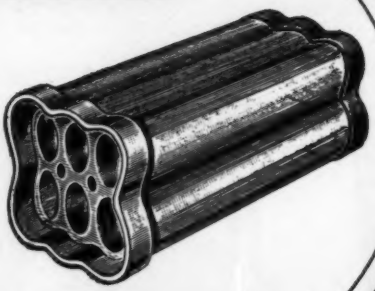
ORIGINAL MANUFACTURERS OF

Self-aligning

SALT-GLAZED STONEWARE MULTIPLE and SINGLE WAY with SELF-ALIGNING JOINTS

also

Rectangular Troughing and Glazed Bridge Insulators for Underground Electrical Cables



Conduits

PROMPT DELIVERY

ALBION CLAY CO. LTD.

ALBION WORKS, WOODVILLE, Nr. BURTON-ON-TRENT

Telephone : Swadlincote 7041, 7042, 7043 Telegrams : "Albion, Phone, Woodville"

THE TRADE MARK for the highest quality of INSULATED WIRES AND STRIPS

SIMS REGD

F. D. SIMS LIMITED

P.O. BOX 8, Hazelhurst Works
RAMSBOTTOM, Manchester
Telephone : Ramsbottom 2213/4/5
Telegrams : "SIMS" Ramsbottom
London Office and Stores :
106 Newlands Park, Sydenham, London, S.E.26
Telephone : SYDenham 4211/2

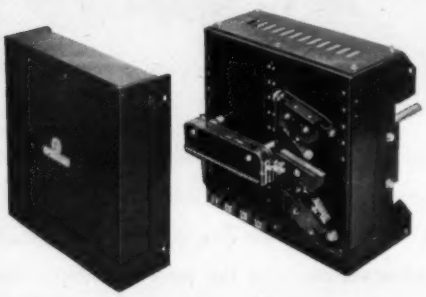
S46

JM

JOHN MORRIS

ELECTRICAL ENGINEERING CO. LTD.

BILSTON TEL. 41237-8 STAFFS



MECHANICALLY OPERATED

TENSION REGULATORS

used to control reeling motors in the Rubber, Steel and Paper Industries, etc.

Available with shaft extension for geared drives or operating lever for festoon regulation.

The relative merits of air-break or oil-immersed switchgear can be argued to and fro and up and down — and often are. Each has its field of usefulness some advantageous over the other . . . often, from a technical point of view, the points are pretty evenly balanced. And so we make both types. Oil-immersed up to 11 kV and 500 MVA rupturing capacity. Air-break — up to 600 volts and 3000 amps. Both types benefit from our own testing facilities at Chelmsford. In one of the most up-to-date A.S.T.A. stations in the country we can measure and record exactly what happens inside a circuit breaker on short-circuit conditions up to 390 MVA at 11,000 volts. Equipment in every way typical of a company with a long history in electrical affairs —

Crompton Parkinson LIMITED

In association with Cooke and Ferguson Ltd.
Member of the Nuclear Power Consortium:
ATOMIC POWER CONSTRUCTIONS LTD.

MAKERS OF ELECTRIC MOTORS OF ALL KINDS · INSTRUMENTS
ALTERNATORS & GENERATORS · SWITCHGEAR · B.E.T. TRANSFORMERS
CABLES · CEILING FANS · LAMPS
LIGHTING EQUIPMENT · BATTERIES
STUD WELDING EQUIPMENT
TRACTION EQUIPMENT

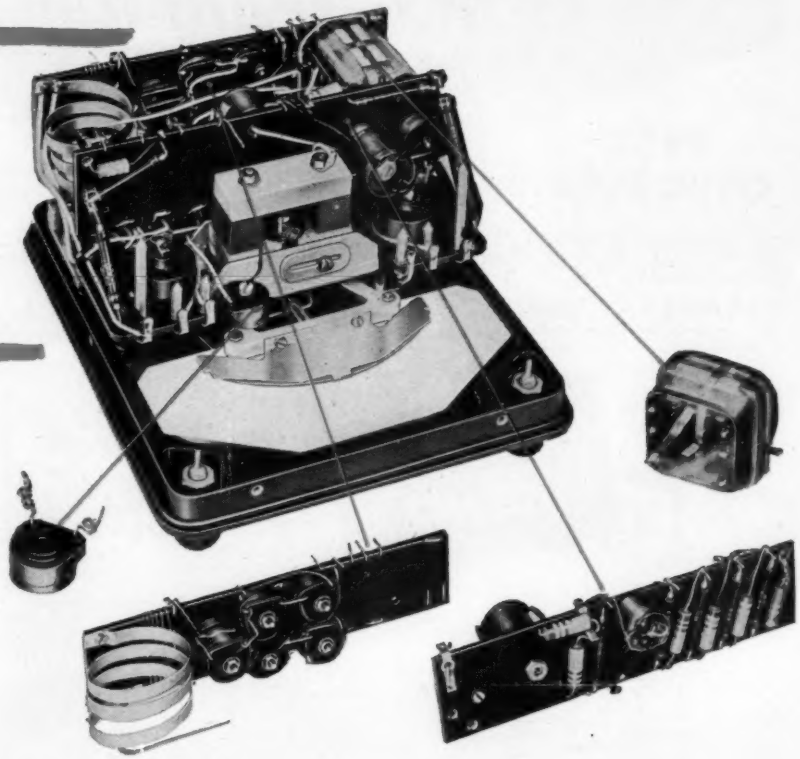
ASTA TESTED IN ASSOCIATION TESTING STATION

ELECTRICAL EQUIPMENT

CROMPTON PARKINSON LIMITED, CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2

The famous Avometers are possibly the most widely used instruments of their type in the World and have an excellent record of service under all climatic conditions, even at arctic temperatures. In tropical climates, however, there is a constant risk of derangement due to humidity, heat, and the development of fungoid growths. To meet these conditions, the manufacturers of Avometers have produced special types known as Models 7X, 8X and 8(S)X, which are suitable for continuous use in any extremes of heat or cold. In these instruments, certain components are potted in Araldite epoxy resin, which has the advantages of remarkable adhesion to metals, ceramics, etc., good dielectric properties, low shrinkage, resistance to moisture and extremes of climate, and complete freedom from micro-biological attack.

Poles apart



Araldite epoxy resins have a remarkable range of characteristics and uses.

They are used

- ★ **for bonding metals, porcelain, glass, etc.**
- ★ **for casting high grade solid insulation**
- ★ **for impregnating, potting or sealing electrical windings and components**
- ★ **for producing glass fibre laminates**
- ★ **for producing patterns, models, jigs, tools, etc.**
- ★ **as fillers for sheet metal work**
- ★ **as protective coatings for metal, wood and ceramic surfaces**

Araldite *epoxy resins*

Araldite is a registered trade name

Aero Research Limited A CIBA COMPANY. *Duxford, Cambridge. Telephone: Sawston 2121*

AP316

d.c. from a.c.

silicon

germanium

selenium

copper-oxide

all by Westinghouse Brake and Signal Co. Ltd., 82 York Way, King's Cross, London, N.1
Telephone: TERminus 6432

CRATER

PHONE
WOKING 4733

ROTARY SPECIALISTS

"C SERIES"
Rotary
15/30 amps. 220/440 V, AC.
Up to 8 positions

OTHER ROTARY TYPES
MF Series 5 amps. 250 V, AC.
Up to 12 positions
R. 10 Series 10 amps.
250 V, AC./DC.
Up to 8 positions
Hermetically Sealed
Key Operated

Single and Multi-way
Push Button Switches
Appliance Switches

TYPE APPROVED
SWITCHES

CRATER PRODUCTS LTD • LYE WORKS • WOKING • SURREY

Pressure Diecastings

in Mazak Zinc Alloy

Produced to B.S.S. 1004 under strict Metallurgical Control

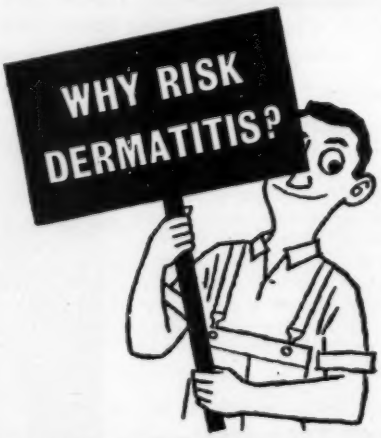
A.I.D. APPROVED

Members Zinc Alloy Die Casters Association

CERTIFIED ZINC ALLOY ZAMCA DIE CASTERS

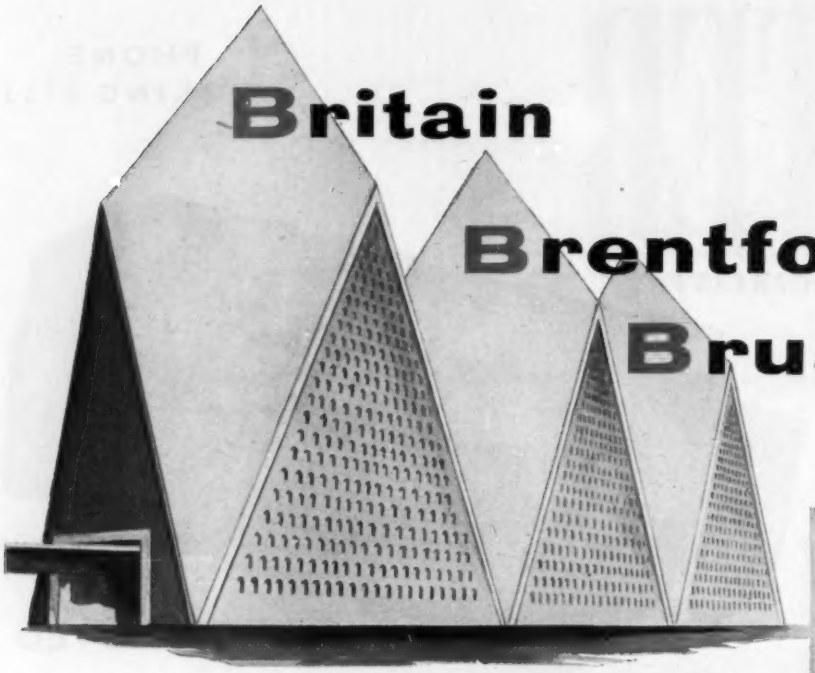
WESTERN DIECASTING LTD.
Phoenix Street, Maze Street
Barton Hill, Bristol 5. Phone 5-6593

R87E



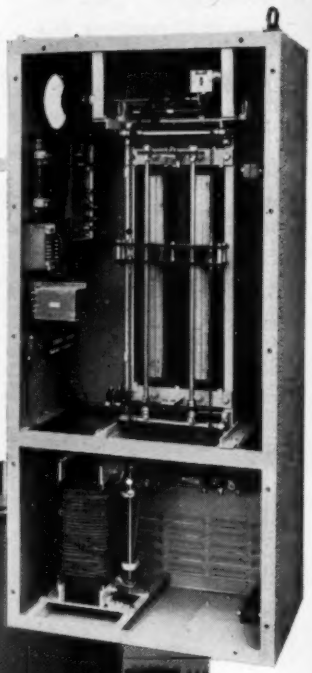
Lost hands or full production? Dermatitis—the cause of more lost man-hours than any other industrial disease—can be avoided simply by using Rozalex. For over 25 years Rozalex have specialised in barrier creams for industry. They have found the answer to most industrial skin irritants. The full technical resources and experience of Rozalex are at *your* disposal on request to Rozalex Ltd., 10 Norfolk Street, Manchester 2.

ROZALEX
BARRIER CREAMS

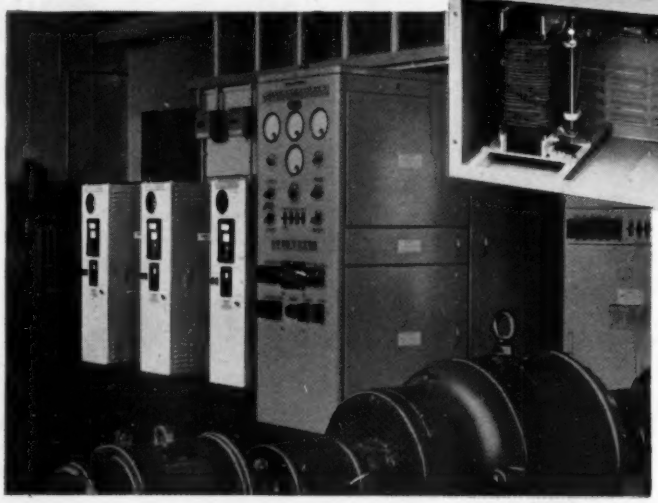


- what's the connection?

The connection lies in a cable link between Britain and Brussels which carries traffic to the British National Pavilion at the Brussels International Exhibition. The lines pass through the G.P.O. Canterbury Repeater Station where Brentford Regulators stabilize the A.C. supply to the transmission equipment.



These regulators have been made and supplied to G.P.O. specifications. They are intended to operate for long periods without maintenance attention, and are designed for any nominal input voltage between 200 and 250 volts single phase, variable by plus and minus 15%, over a frequency range of 45 to 50.5 cycles. The output is held constant to within plus and minus 1½% of the nominal input voltage at any load between 5% load and full load.



BRENTFORD REGULATORS HAVE THESE FEATURES

* **Simplicity**
* **Robust construction**
* **No effect on power factor**
* **Unaffected by frequency variation**

BRENTFORD REGULATORS
for Telecommunications

BRENTFORD TRANSFORMERS LIMITED · MANOR ROYAL · CRAWLEY · SUSSEX · Telephone : CRAWLEY 25121

Improved SANTON 'DUAL' IMMERSION HEATER

now at a REDUCED PRICE

So successful has been the 'DUAL' Immersion Heater that production has now reached a point where substantial savings can be passed on to our customers.

Remember it is no larger, and is as easy to install as an ordinary immersion heater — yet it heats a limited quantity of water as fast as a vertical heater and is as efficient as a horizontal heater for bulk supplies.

When used with the special Santon Dual control unit both heaters cannot be on at the same time, and the housewife cannot heat too much water to too high a temperature at the 'sink' position through forgetfulness.

It will pay you and your customers to install this heater so write now for full details of the new, improved 'DUAL' at the new low price.

SANTON

SANTON LTD.

NEWPORT · MON. Telephone : NEWPORT 71711

LONDON : Shepherds Bush 3311/2
BIRMINGHAM : Midland 6421/2
MANCHESTER : LONgford 4226/7
NEWTON ABBOT : 1638
LEEDS : 28762

C

9" to 48" FANS

by HOWELLS

ONE TWO AND THREE PHASE

MOTOR. Of the Squirrel Cage Totally Enclosed Type complying with the B.S. Specification, terminal cover screwed for conduit. On single phase the Motor is supplied with a condenser permanently connected for power factor correction and quiet running.

CONSTRUCTION. The Motor is secured to a Ring which is a high grade iron casting of extremely robust construction by arms of forged mild steel of ample strength to give rigidity to the complete Unit.

BLADES. Made from high quality mild steel sheets, vanes riveted to a centre boss and designed to give maximum output with minimum power consumption.

Many sizes available EX-STOCK

Leaflet giving full details available on request.
PLEASE QUOTE P105E

TOTALLY ENCLOSED

HOWELLS
(ELECTRIC MOTORS) LTD
HANLEY · STOKE-ON-TRENT

Branches at
LONDON · MANCHESTER · BRISTOL
BIRMINGHAM · GLASGOW · LEEDS

30 MAY
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Controlling the British Grid 1005
For greater flexibility and to allow for expansion a new standard grid control system is being introduced which will be less dependent on the G.P.O. trunk exchanges

Particle Accelerators 1007
In this article the authors, who are with the United Kingdom Atomic Energy Authority, deal with the basic principles of design and operation. Part 2 will briefly review the many applications of particle accelerators in nuclear physics research

Engineering Standards Conference 1015
One of the matters discussed at the fourth annual conference of standards engineers was the use of the imperial and metric systems

Grid Communications 1027
Two I.E.E. Supply Section papers presented this week described the new " standardised system " of grid control and gave details of the indication and telemetering equipment

Electrical Accidents 1031
Excluding eye-flash from welding, there were 797 reportable electrical accidents in 1956 of which 40 were fatal, compared with 739 (42 fatal) in the previous year

Overseas Electrical Trade 1032
British electrical exports last month totalled £11·8 million, an increase of £1·3 million over the corresponding month of 1957. Canada was the leading purchaser of generating plant, taking equipment to the value of £836,000

Power for Board Mill 1034
A paper board mill recently brought into production at Thatcham, Berks, has its own power station equipped with two turbo-alternator sets. A standby supply is provided by the Southern Electricity Board

✧ ✧ ✧ ✧

New Books	1016	**New Electrical Equipment**	1039
Views on the News	1017	**Generation and Development**	1041
Personal and Social	1018	**Financial Section**	1042
Parliamentary Report	1021	**Next Week's Events**	1044
Industrial News	1023	**New Patents**	1045
E.T.U. Resolutions	1036	**Contract Information**	1046
Plant Engineers	1037	*CLASSIFIED ADVERTISEMENTS*	97
Switzerland's Electrical Trade	1038	*INDEX TO ADVERTISERS*	106

VOLUME 162 NUMBER 22 ✧ *Eighty-Sixth Year of Publication* ✧ FRIDAY PRICE 1s 6d

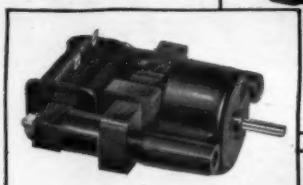
Editorial, Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: " Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home £4 15s 0d; Overseas £5 15s 0d: U.S.A. and Canada $16.00. Cheques and Postal Orders (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed " Lloyds Bank."

'SYNCLOCK' ELECTRIC MOTORS

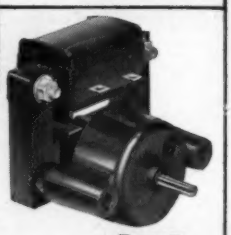
RANGE EXTENDED TO SEVEN BASIC TYPES

The "Synclock" Synchronous Motor is of the hysteresis type, is self-starting and has a predetermined direction of rotation. Used as the power drive for all forms of time mechanisms and in instrument and process control equipment, it is available in light or heavy duty types, specially high torque models and reversible types. All are described in a new brochure (Sheet 600A) giving full technical data and dimensions. Please write for a copy.

Type BX

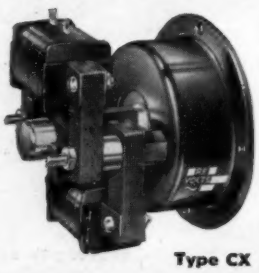


Type BE



Type B

Type C



Type CX

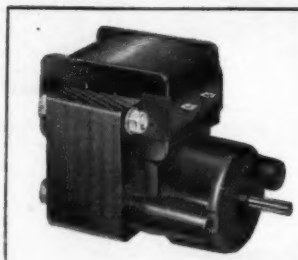
Some applications of ELECTRIC SYNCLOCK MOTORS

Time Interval Meters

The majority of "Synclock" Motors are available for immediate delivery.

- Air Conditioning Control
- Aircraft Flight Simulators
- Advertising Devices
- Cam-Operated Timing Devices
- Cycle Controllers
- Echo Sounders
- Electric Clocks
- Flow Control
- Graphic Recorders—all types
- Oil Burner Controls
- Process Timers
- Programme Controllers
- Railway Signalling
- Revolution Counters
- Stoker Control
- Time Clocks
- Time Delay Relays
- Time Stamps
- Time Switches
- Traffic Signals
- Voltage Regulators
- Vulcanising Timers
- Watch Testing
- X-Ray Apparatus

Process Timer



Type BK and BKX

Type CK and CKX

EVERETT EDGCUMBE SYNCHRONOUS MOTORS

EVERETT EDGCUMBE & CO LTD COLINDALE WORKS, LONDON, N.W.9 *Telephone: Colindale 6045*
LONDON OFFICE: COLUMBIA HOUSE ALDWYCH W.C.2 - Telephone: Chancery 5953/4

DH8/3095

ELECTRICAL REVIEW

30 May 1958 Vol. 162 No. 22 Established 1872

Controlling the British Grid

WHEN the British grid system first came into being about 26 years ago as a result of the 1926 Electricity Act, the country was divided into a number of areas each of which had its own control centre situated near the principal load centre of the area. For several years these control areas functioned as separate grid systems but from 1938 they were operated as one country-wide interconnected system under the direction of a national control centre in London. For communication purposes lines were rented from the G.P.O. and each control centre depended very much on the local trunk exchange, which gave rise to a number of embarrassing incidents during the war. Furthermore each control area had its own ideas and various systems of general indicating, telephone and telemetering equipment were in use.

The fact that this lack of standardisation was undesirable was recognised in the early days of the nationalisation of the electricity supply industry. It was decided to do something about it and a committee was formed by the British Electricity Authority and three telephone manufacturers to design a standard system for use throughout the country. Earlier this week two papers describing this system and the equipment employed were presented at a London meeting of the Institution of Electrical Engineers and summaries of these papers by the authors are published in this issue. This standardisation has been necessary not only to simplify maintenance and replacement of equipment but to give greater flexibility of control and allow for ready expansion with the growth of the grid system. At the present time the British 132 kV and 275 kV grid connects 390 transmission and 280 generating stations with an aggregate capacity last month of 24,000 MW and it is certain that this figure will continue to increase at a fairly substantial rate for many years to come.

Essentially, what has been done so far is to build new grid control centres in each of the areas and in strategically safe positions. Although rented G.P.O. lines are still employed, the control centres no longer depend on trunk exchanges. A new national control centre is being built in London and when all the area control centres are in full operation this will be commissioned to take overriding control of the whole national network.

Several of the area control centres have already been completed and yesterday we had the opportunity of inspecting one of them and an article describing the function-

ing of the standard system and the equipment employed will be published in our next issue. From what we saw during this visit, however, it is evident that a very great deal of careful thought has gone into the planning of the system and the design of the apparatus. The new control centres provide an outstanding example of the value of standardisation and the excellent co-operation between the manufacturers and the electricity supply authority has completely avoided duplication of effort and has enabled the best use to be made of both design staff and manufacturing capacity.

COMPETITION AND DUPLICATION

The launching of the third Russian satellite is a reminder that in addition to sheer size the Soviet Union has the advantage of being able to organise and concentrate its scientific and industrial effort on the activities which it thinks are of greatest importance. In those countries which believe in competition and free enterprise agreement on the use of resources is not so simple, but, as Mr. Reginald Maudling pointed out at the S.I.M.A. annual luncheon, it is " important to ask ourselves where competition ends and duplication begins." A certain amount of duplication is probably desirable for variety and to provide a cross-fertilisation of ideas, but where it involves the wasteful use of scarce scientific manpower it is obviously harmful to the country's progress and competitive position.

One of the main causes of duplication is the secrecy that necessarily surrounds much research and industrial activity. Another is the problem of finding out what has been done, even when the results have been published. To overcome these difficulties, the S.I.M.A. have had the commendable idea of setting up a consultancy service, which will enable members to discuss with the director of the industry's research association the work they propose to undertake. The president of the association, Mr. Goudime, would like to go even further than this and find a way of reducing duplication between Western European countries. If this were possible, he maintains, the combined scientific effort in Europe would surpass that of Russia.

IRON CURTAIN TRADE

Russia's recent scientific and industrial progress have also made it clear that Soviet scientists are not unduly deterred by their inability to obtain from this country much of the equipment which they would like to use. As Mr. Goudime emphasised in the same speech, they are perfectly capable of copying the wide range of instruments that we are not allowed to export but which they can inspect and discuss at many international exhibitions. The scientific instrument manufacturers believe that they could increase their trade with the Iron Curtain countries to some three times its present level, and to this end they are exploring the possibilities of holding exhibitions in Peking and in Moscow.

The expense and effort involved in such exhibitions will, of course, be largely wasted if the participating firms are prevented from selling the most modern and original of their products: those products in fact on which Britain's reputation and prospects depend. The controls on the export of so-called " strategic " goods to China were last year brought into line with those governing trade with Russia. There is now a strong case for a further relaxation of the restrictions, and this should be pressed by the whole electrical industry.

ENGINEERING STANDARDS

The fourth annual standards engineers' conference was held last week in London (see page 1015). This one-day conference provides a meeting ground for British standards engineers and its popularity has increased to the extent that 250 delegates attended the conference. The delegates were drawn from all branches of industry and the subjects discussed were of a fairly general character. The two main points raised were the implementation of standards and the need for a new approach to international standards on the part of British industry. It was thought that many industrial companies in this country, particularly the smaller ones, have little interest in standardisation provided they continue to sell their products. In many Continental countries standards are mandatory and there would seem to be a good case for legislation in this country.

Great Britain is not as well represented at international standards conferences as could be expected. Managements should realise that unless first-class executive engineers attend these conferences and make the British viewpoint felt export trade is bound to suffer. Much more attention must be paid to standards and it is hoped that this conference will help to publicise the fact.

MAKING PORTABLE APPARATUS SAFE

One of the most important facts again emerging from the Factory Inspectorate's annual report on electrical accidents, which is reviewed in this issue, is that during the last five years portable electrical apparatus of one sort or another has been responsible for nearly half the electrical fatalities and for about a third of the total number of electrical accidents. This makes it evident in what direction further efforts must be made to improve safety standards, and the figures quoted in the report support and confirm the line which has been taken by the inspectorate for many years. Although there are many ways of improving the safety of portable electrical apparatus, and these depend upon the circumstances in each particular case, the problem is usually best tackled at the source, i.e. by reducing the operating voltage. If this is kept low enough to be safe then a whole range of hazards is ruled out.

ELECTRIC TOASTERS

Details of the various makes of automatic and non-automatic toasters available will be given in next week's domestic equipment survey. Particulars will include type, number of slices, loading, body finish, price and purchase tax, and many models will be illustrated. The subsequent survey (4th July) will deal with electric fires

Particle Accelerators

By N. M. KING and A. J. EGGINTON*

SINCE the first artificially-produced nuclear disintegration in 1932, particle accelerators have played an increasingly important part in the nuclear-physical scene. The need for producing, as experimental tools, particles of higher and higher energies, has resulted in the construction of machines of ever-increasing complexity, so that a modern high-energy accelerator may require up to six years for design and construction, and may cost several million pounds.

The first accelerators were d.c. machines of the type now known as Cockcroft-Walton sets, depending on the direct application of high voltages to the charged particles. A later type of equipment, differing in the method of building up voltage, is the Van de Graaf generator. Although nowadays classed as low-energy accelerators, such machines still find considerable application, both as pre-accelerators injecting into larger machines, and as nuclear physics instruments in their own right. We shall not discuss them further in the present article.

I.—BASIC PRINCIPLES OF DESIGN AND OPERATION

When Cockcroft and Walton "split the atom" in 1932, the energy of bombarding particles at their disposal was only about 700 keV. However, a great deal of effort had already been directed towards the attainment of energies in the MeV range. E. O. Lawrence in California had developed a "resonance magnetic accelerator," and was able to repeat Cockcroft and Walton's experiment shortly after the Cambridge announcement. The resonance accelerator is now familiar to everyone as the cyclotron.

The cyclotron embodied two principles which have formed the basis of a whole series of accelerators since that time. First, it recognised that very high energies cannot be attained by direct application of large voltages, such processes being subject to the usual limitations of electrical breakdown, besides being economically prohibitive. Instead, the ions were accelerated by means of a high-frequency electric field.

Secondly, it made use of the fact that charged particles describe circular orbits in a magnetic field, and hence may be made to pass through the same accelerating gap a great many times. In a large circular machine now under construction, the ions will travel about 200,000 miles during their acceleration to 25 BeV (1 BeV=1,000 MeV).

Circular accelerators comprise the cyclotron, synchro-cyclotron, microtron, betatron and synchrotron. The betatron uses a different principle of acceleration from the others, but, nevertheless, has a logical place in the scheme of accelerator development. The microtron is a less familiar machine which strikingly illustrates the great difference in relativistic behaviour of electrons and ions.

Acceleration by r.f. fields has also been employed in linear machines, and electron and ion linear accelerators have their advantages for certain applications. The particles are accelerated along the length of the machine, picking up energy from a travelling wave or from a succession of voltage gaps.

In every accelerator, the particles must be kept focused; the machine is designed for an "equilibrium particle," and all other particles must describe stable oscillations around it. The focusing to be achieved is one of the major design considerations, and often presents difficult problems. In linear accelerators, the r.f. accelerating fields tend to defocus the particles, and some form of extraneous focusing device must be employed.

In circular machines, the problem is more fundamental. The form of guiding magnetic field required for focusing conflicts with the form required for optimum acceleration, so that a compromise must be made. The net result is that focusing is achieved at the expense of beam intensity, and in general, the higher the desired energy, the smaller is the beam current. For example, a reasonable current from a 20 MeV cyclotron would be several hundred microamps (μA), but the average current expected from the 25 BeV machine now being constructed by C.E.R.N. is only about 10^{-4} μA (10^9 protons in each pulse, arriving every 5 sec). Even this small intensity will have been achieved with great difficulty and at great cost.

However, despite the popular conception of accelerator development, the aim is not merely the attainment of the highest possible energies, although this policy has been necessitated in the past by developments in nuclear physics. The advantages of higher beam intensities are fully realised. Designers are following two lines of attack on the problem; one is to make use of modern technological development and operating experience in an effort to improve existing types of accelerator. For example, a 7 BeV proton synchrotron under construction at Harwell is expected to yield a current of about 10^{12} particles per pulse every 2 sec.

The other method of attack is to return to the fundamental focusing problem, and devise some way of overcoming it. A recent development in this connection is the principle of f.f.a.g., or "fixed field, alternating gradient" focusing, formulated by the M.U.R.A. group of universities in the United States. The problems involved are exceedingly complex, and several years may elapse before it can be established whether a feasible design can be based on this principle. Prospects seem rather brighter with a related type of machine, the spiral ridge cyclotron, which may prove very useful in the energy range below 1 BeV.

A more distant prospect is the scheme proposed by Budker in the U.S.S.R., for accelerating ions in the very intense self-magnetic field created by a collapsed electron beam.

Linear Accelerators

Development of modern linear accelerators ("linacs" in accelerator slang) owes much of its success to radar experience acquired during the last war. The first

* The authors are with the United Kingdom Atomic Energy Authority.

electron linac, giving 4 MeV electrons, was built by a British team at T.R.E., Malvern, in 1948. Experience with microwave techniques also provided the impetus for research on proton machines, and in 1945, L. W. Alvarez instituted a design study for a 30 MeV proton linac at the University of California. The methods used for electron and ion acceleration are fundamentally different, owing to the great disparity between the relativistic behaviour of the particles.

Electron Linacs.—In the travelling wave electron linear accelerator, an electric wave is propagated, with changing phase velocity, along a cylindrical guide. Electrons injected into the guide " ride on the crest " of the wave, picking up energy from it; the machine is designed so that they gain energy at just the correct rate to keep in step with the wave. The phase velocity is controlled by loading the guide with concentric discs. A suitable wavelength is about 10 cm. Owing to their small mass, electrons very quickly become relativistic, and after they attain an energy of about 2 MeV, further energy increase results in a very slight velocity change. Hence the linac may be divided into two regions, in the first of which the phase velocity is carefully controlled to keep in step with the electrons as they are accelerated to 2 MeV. In the second part the phase velocity need be varied very little, being nearly equal to the velocity of light, c. The method of loading may be seen in Fig. 1. Photographs of the 15 MeV machine at Harwell, and part of the more modern 1 BeV linac at Stanford University, are shown in Figs. 2 and 3.

Proton Linacs.—Protons do not approach the velocity of light until their energy is very great; for instance, $\beta=v/c$, does not reach the value 0·9 until the proton kinetic energy is 1·2 BeV. The necessary phase velocities for travelling wave acceleration of protons would therefore be very small and difficult to control; the wavelengths required are about an order of magnitude greater than for electrons. In the Alvarez type of machine, an E_{010} wave is generated in a large resonant cavity. The protons, injected at an energy of about 500 keV from an h.t. set, are protected from adverse phases of the field by a series of " drift-tubes " arranged along the axis. Provided they are injected within a certain range of phase, they are accelerated in the gaps. Since the r.f. frequency is constant and the proton energy in successive drift-tubes increases, the length of drift-tube must increase along the machine (see Fig. 4).

The r.f. electric field in linear accelerators has a radial component which tends to defocus the particles. In the electron machine the effect is not so troublesome, and may be overcome by providing a small solenoidal magnetic field along the length of the guide. The power required to use this method in a proton linac would be excessive, and other methods have been devised.

One way is to provide thin metal grids across the entrances to the drift-tubes. These tend to make the electric field lines in the gaps end up normal to the drift-tube cross-sections, thus reducing the defocusing forces. The disadvantage of this method is that part of the beam is lost in collisions with the grids. The loss builds up in an exponential manner, so that in a long machine with a large number of drift-tubes, the final beam current would be only a small fraction of that injected. Nevertheless, this method of focusing is still useful at low energies, where the drift-tubes may be short and there is not sufficient space for the incorporation of alternating-gradient lenses.

Alternating-gradient or a.g. focusing will be considered later in connection with synchrotrons, for which it was first designed. However, it was immediately realised that the method would be extremely advantageous in linear machines, where the drift-tube structure could be used to

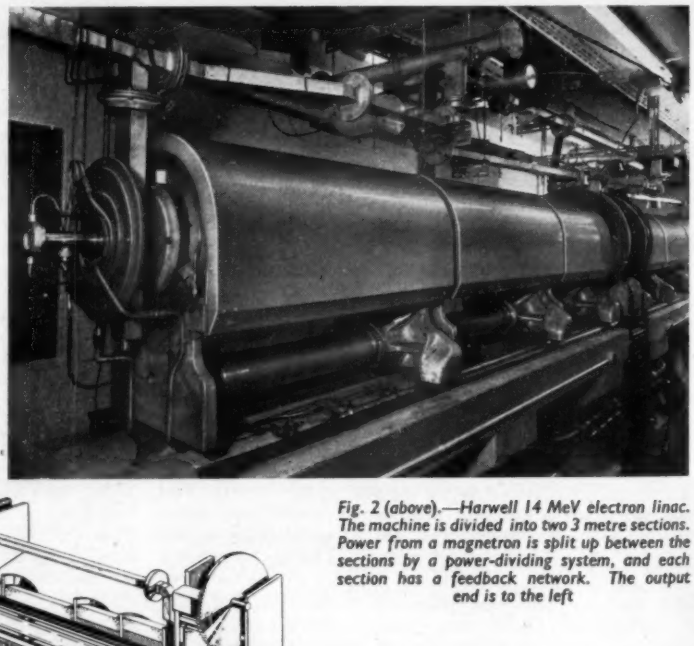


Fig. 2 (above).—Harwell 14 MeV electron linac. The machine is divided into two 3 metre sections. Power from a magnetron is split up between the sections by a power-dividing system, and each section has a feedback network. The output end is to the left

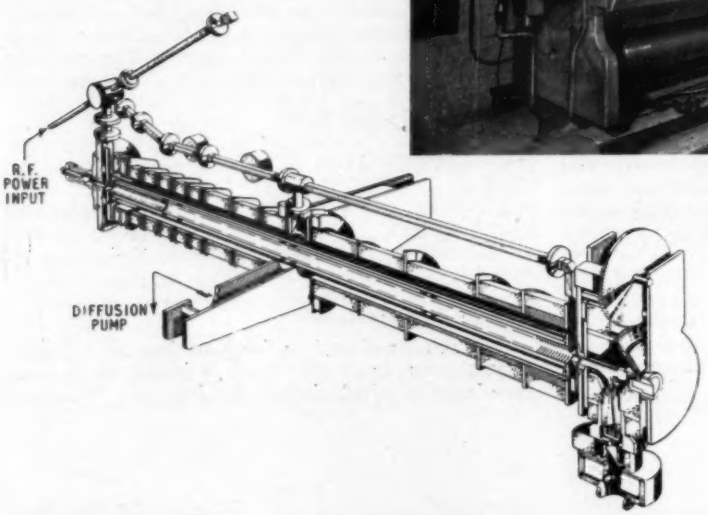


Fig. 1 (below).—Perspective sketch of 10 MeV electron linac constructed for the M.R.C. R.f. power is conserved by a feedback network (on the left of the diagram). The output end of the machine is fitted with an X-ray head, the beam being bent through a right-angle. The method of disc-loading, the vacuum system and the magnetic focusing coils may also be seen

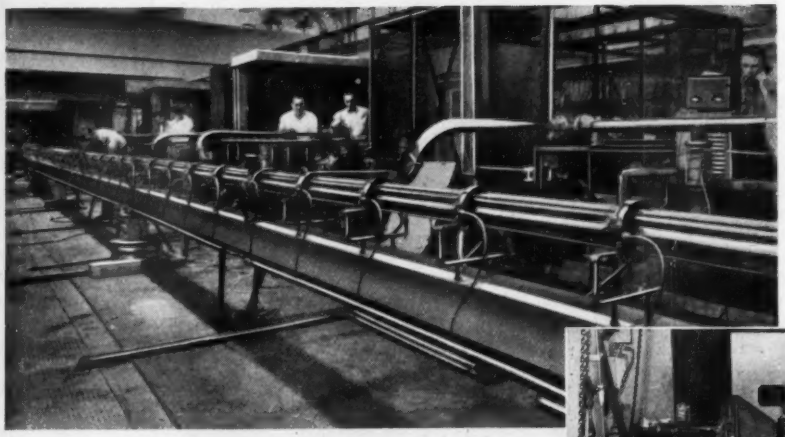


Fig. 3.—Part of the 1 BeV electron linac at Stanford University. This machine is divided up into 3 metre sections; it has no feedback, and r.f. power is fed in at regular intervals from klystrons. The waveguide forms its own vacuum system, and at high energies focusing coils are not necessary

house the lenses. In the form used in linacs, the a.g. magnetic lenses consist of four hyperbolic polepieces. Protons are focused towards the axis in one plane and defocused in the plane at right-angles; the planes are interchanged in successive lenses. The net effect is a focusing one, capable of overcoming the r.f. defocusing forces.

Phase Stability.—The r.f. accelerating systems described here depend for their success on their inherent phase focusing properties. We may represent the electric field at a given point as a time-varying sinusoid (see Fig. 5). The machines are designed so that a "synchronous particle" injected at phase ϕ_s gains energy in just the correct way to remain at ϕ_s in the electron linac, and to reach the centre of every accelerating gap at this phase in the proton machine.

It may be seen from Fig. 5 that a particle which has gained too much energy (i.e. which arrives too soon at the point of observation), will gain only the amount of energy corresponding to the phase position "A," say, and will be slowed down with respect to the synchronous particle. In the same way, slower particles arrive later than ϕ_s and so gain more energy than the synchronous one. The equations of motion show that, provided they are injected within a certain range of phase, the particles execute stable phase oscillations about the synchronous position. Further, as their energy increases, the oscillation amplitude damps. In the electron machine, they are "bunched" within a few degrees of phase by the time they have traversed the "changing phase velocity," or "phase bunching" section, and from then on they travel down the machine in isolated bunches. The damping is less rapid in proton linacs but is still an important effect. It may be increased by judicious control of the parameters.

Phase focusing is also vital to the performance of circular machines. With certain exceptions, to be discussed later, the synchronous position in that case is on the other side of the voltage peak.

Electron linear accelerators are now chiefly used as low-energy installations for medical and other applications. However, a 1 BeV machine has recently been constructed at Stanford University; it is about 100 yd long and provides a mean current in the pulse of about 50 mA with an energy spread of about 12 MeV.

Several proton machines have now been built or are in course of construction, chiefly for use as injectors for large circular machines. Until about three years ago proton linear accelerators appeared to have considerable advantages for energies up to about 1 BeV, offering a "clean"

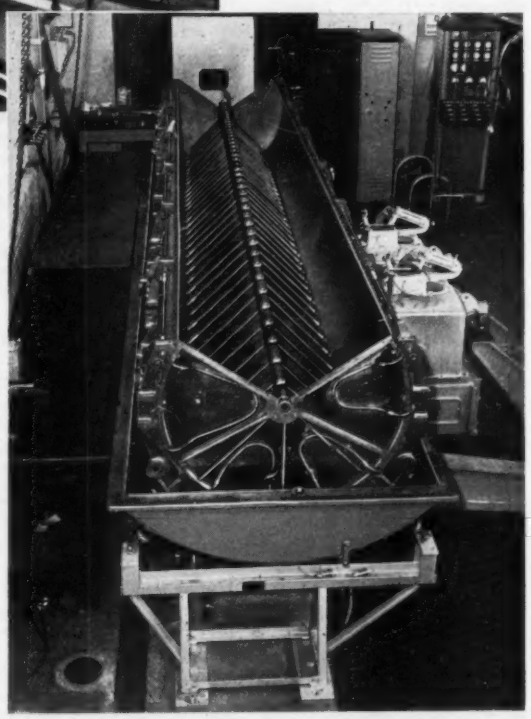


Fig. 4.—0·5–10 MeV section of the 50 MeV Harwell proton linac. The r.f. liner rests inside an outer vacuum envelope, the top section being removed. Drift-tubes (with grid focusing) are supported on two stems; the output end is in the foreground

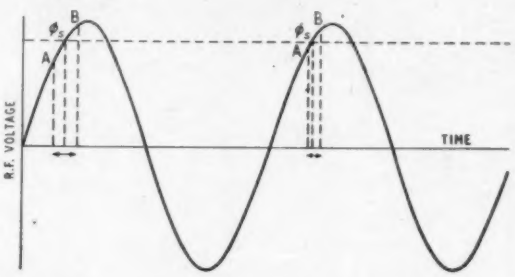


Fig. 5.—The principle of phase stability. Particles with too much energy arrive before the synchronous phase ϕ_s, at point A, say. Hence, they gain less energy than the synchronous particle, and oscillate about ϕ_s on subsequent cycles. Similarly, slow particles arrive later, at point B, say, and gain more energy

beam of relatively high intensity and presenting no extraction problem. However, an improved method of extraction from synchrocyclotrons rendered the latter machines slightly more attractive economically. Nevertheless, with increased operating experience and improving techniques, the proton linac may yet find application in the high energy range.

Conventional Circular Machines

The C.W. Cyclotron.—The basic principle evolved by Lawrence for the cyclotron has since been extended to a whole family of circular accelerators, and modern machines provide particles of many thousand times greater energies than the first cyclotron. The fixed frequency, or continuous wave (c.w.) cyclotron operates on the principle whereby ions emitted from a source at the centre of the machine are accelerated across the gap between two hollow D-shaped electrodes. Inside a "dee," the particles are protected from the r.f. electric field, and describe a semi-circular orbit under the action of the magnetic field. On re-emerging at the gap, they will be accelerated once again, provided that the frequency of the electric field has been chosen correctly. Since the equilibrium radius r of a particle with mass M, velocity v, and charge e, in a magnetic field B, is given by $r=Mv/eB$, its orbital frequency v/r will be $\omega = eB/M$. If the accelerating frequency is set equal to ω, the "cyclotron resonance condition" is achieved, and the particles spiral out in radius, gaining energy at each gap traversal.

Synchrocyclotrons.—Unfortunately, this process will not continue indefinitely. In the above formula for ω, the relativistic mass, M, appears. As the particles are accelerated, M increases according to the relation $M=M_0/(1-\beta^2)^{\frac{1}{2}}$. Hence, if ω is to remain constant B must increase with radius. This is best described with reference to a "magnetic field gradient parameter," n, defined as $\left(-\frac{r}{B}\cdot\frac{dB}{dr}\right)$. We find that c.w. operation requires $n=(1-\gamma^2)$ where $\gamma^2=1/(1-\beta^2)$, so that n should decrease from zero at the centre. The focusing conditions in the radial and vertical planes may also be described in terms of n, and here the difficulty becomes apparent. The radial focusing condition is $n<1$, but for vertical focusing we must have $n>0$. Hence, if we are to maintain vertical stability, we cannot have c.w. operation.

The effect is not important for proton energies below about 20 MeV, and in the c.w. cyclotron the field is allowed to fall off slightly with radius ($n>0$). Above this energy, the relativistic mass increase causes the particles to fall out of step with the r.f. (phase slip). The difficulty is circumvented in the synchrocyclotron, where the r.f. frequency is modulated to keep the accelerating field in phase with the particles' gap traversals (see Fig. 6). A "bunch" of particles is accelerated with each modulation cycle, so that the beam emerges as a series of pulses. The first synchrocyclotron was built shortly after the war at the University of California. With modern techniques, the range of cyclotron operation may be extended to the 600-700 MeV range, as in the recently constructed synchrocyclotrons at C.E.R.N. and Moscow. The gain in energy is achieved at the expense of beam current; currents of up to 1 mA are obtainable from c.w. machines, but synchrocyclotrons provide only about 1μA mean current.

The Microtron.—We note, in passing, that cyclotron acceleration of electrons is not possible, owing to the fact that they so quickly become relativistic. Fortunately, however, their rest energy is small (0·511 MeV), and this fact is made use of in the microtron shown schematically in Fig. 7. In this machine, a cavity resonator is used to give electrons passing through it an energy increment equal to their rest mass. Describing a circular orbit in the magnetic field, they pass through the cavity on each revolution, gaining 511 keV each time. The above equation for ω shows that their angular frequency on successive revolutions is $\omega, \frac{\omega}{2}, \frac{\omega}{3}, \ldots$ etc., so that they continue to traverse the cavity at the correct phase.

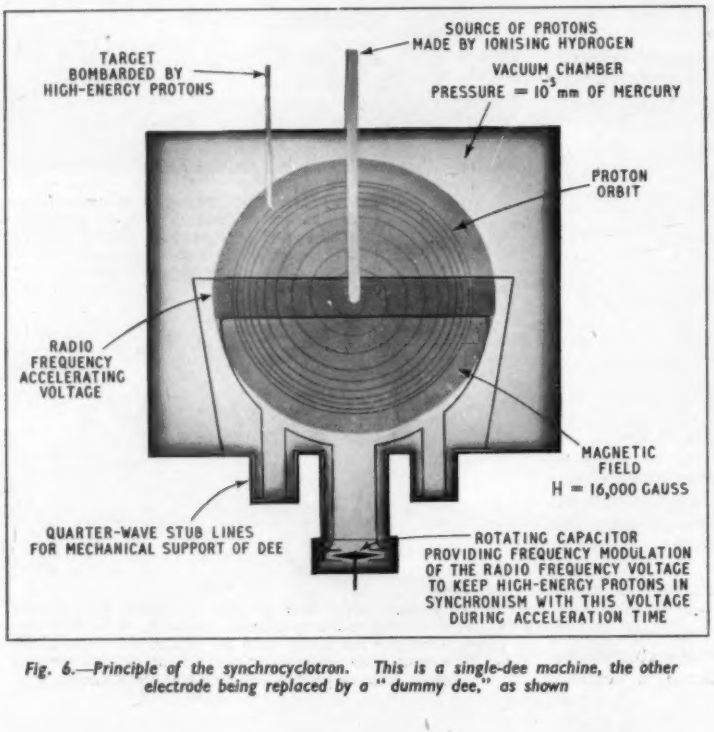


Fig. 6.—Principle of the synchrocyclotron. This is a single-dee machine, the other electrode being replaced by a "dummy dee," as shown

The Betatron.—For proton energies in excess of about 600 MeV, the amount of steel required for synchrocyclotron magnets becomes excessive, and the proton synchrotron is a more economic machine. Before discussing synchrotrons, let us consider a rather different principle of particle acceleration, as used in the betatron, an electron accelerator.

Acceleration in the betatron is accomplished purely by means of magnetic fields. The beam is maintained at constant radius in a toroidal vacuum chamber or "donut" by a time-varying magnetic field provided by a large central-core magnet (see Fig. 8). The changing flux through the electron orbit gives rise to an azimuthal electric field, just as in a transformer; the electrons are accelerated round the donut, analogous to the current in the secondary winding. The restrictions on the field to maintain radial and vertical stability are similar to those for the cyclotron, and in addition, a very stringent condition on the flux threading the orbits must be imposed. The magnet design is therefore a difficult problem, and it

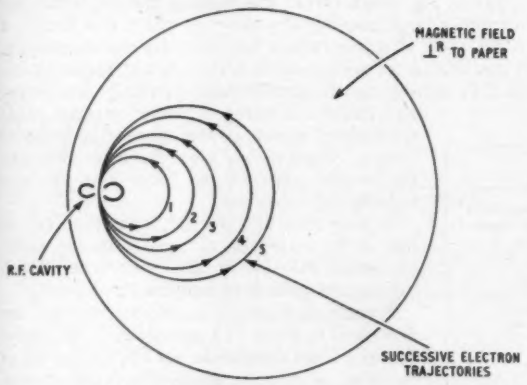
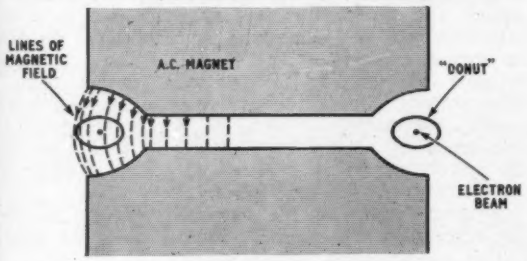


Fig. 7.—Electron acceleration in the microtron. On successive turns, electrons gain an energy equal to their rest mass, 0·511 MeV. Their orbital frequency decreases from ω to $\omega/2$, then to $\omega/3$ and so on. Hence, they continue to pass through the cavity at the correct phase for acceleration

Fig. 8.—Schematic cross-section of betatron. Rising magnetic flux threading the "donut" gives rise to an azimuthal electric field E_θ (in or out of the plane of the paper), which accelerates the electrons. Focusing is ensured by the specially-shaped poles



was not until 1941 that the first betatron was successfully constructed by D. W. Kerst, although the principle had been recognised in 1929 by Wideroe.

At high energies the circulating electrons radiate energy, and with the restrictions on accelerating rate imposed by practical magnetic flux, this limits the energy obtainable from a betatron to about 350 MeV. Betatron acceleration cannot be used economically for protons, owing to their much greater rest mass. Despite these disadvantages, the part played by the betatron as a forerunner of the synchrotron cannot be over-emphasised.

The Electron Synchrotron.—The electron synchrotron is a logical development of the betatron. The large central-core magnet is discarded, and the electrons are maintained at constant radius by means of a sectioned, ring-shaped magnet, fed by an a.c. current (see Fig. 9). Initial acceleration to about 2 MeV is still accomplished by betatron action, thus avoiding the necessity of frequency modulation. From then on, the acceleration is taken over by the constant frequency r.f. electric field in a cavity, forming part of the donut. The magnetic field rises in step with electron energy at just the right rate to keep the particles at constant radius.

The principle of phase stability, described earlier, operates in the electron synchrotron, and this is instrumental in combating the radiation loss limitation. Thus, as the electrons lose energy by radiating, they move closer to the peak of the r.f. and gain just sufficient excess energy to compensate. This process grows uneconomic at high energies, since an excessive amount of power must be supplied by the cavity simply to make up for the radiation loss. Nevertheless, the present limitation is as great as 6 BeV.

The Proton Synchrotron. — Clearly, the ring-shaped magnet of a synchrotron-type machine should require much less steel than a synchrocyclotron magnet for less high energy protons. This is the reason for development of the constant gradient (c.g.) proton synchrotron for the BeV energy range.

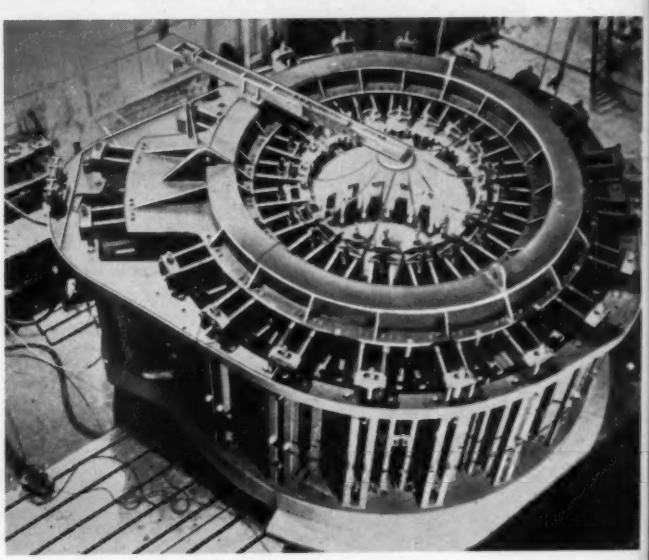
However, the problem of applying the synchrotron principle to protons is complicated by their "non-relativistic" behaviour. We must introduce frequency modulation, and if the range of modulation is to be kept reasonable, the protons must be injected into the machine at energies of at least several hundred keV for a 1 BeV machine; several MeV for higher energy synchrotrons. Gas-scattering considerations also demand high-energy injection, and linear accelerators are usually employed for this purpose.

Thus, the proton synchrotron is a large and complex machine, calling for several years of careful design study from a team of physicists and engineers. Close co-operation is required between groups working on injection, magnet design, power supplies, beam dynamics, r.f. problems, vacuum system, and building layout.

The magnetic field is generally cycled at a rate of once every few seconds, stored energies being of the order 10 to 100 MJ. The radio frequency is tied to the field level by a "tracking system," to ensure that the frequency applied is correct for the particle energy at any instant. This problem demands exceedingly accurate instrumentation.

The magnet is divided into four or more sectors, with field-free "straight sections" between (see Fig. 10); the straight sections are necessary for accommodation of injection, acceleration and extraction systems, and for apparatus in connection with beam control and experi-

Fig. 9.—375 MeV electron synchrotron at Glasgow University. The radius of this machine is 1·25 m, and the protons reach 375 MeV at a field of 10,000 gauss. The distributed yoke can be seen clearly in the outside of the machine, the flux bars for initial betatron acceleration around the centre. On the left, the yokes are specially shaped to leave a clear path for the beam



ment. They do not affect the basic operation of the machine.

Several c.g. proton synchrotrons are in operation or under construction at the present time and some of their characteristics are listed in Table I below.

TABLE I

Machine	Energy (BeV)	Equi-librium Radius (ft)	Magnet Weight (tons)	Injection	Current (protons per pulse)
" Cosmotron," Brookhaven	2·9	30	2,000	3·6 MeV	5×10^{10}
" Bevatron," Berkeley	6·4	50	9,500	10 MeV Linac	2×10^{10}
Birmingham	1·0	15	810	0·46 MeV T.T. Set	10^{9}
Moscow	10·0	92	36,000	9 MeV Linac	10^{9}†
Harwell*	7·0	62	6,600	15 MeV Linac	of order 10^{12}

* Under construction ; present design data. † Will be improved.

New Types of Accelerator

We have seen that one of the most severe restrictions on the design of circular accelerators is the focusing condition $0<n<1$. If n could be made greater than unity, the increased focusing would permit reduction of the aperture inside which the particles circulate. Hence, the size of magnet and its power supply could be reduced.

A.G. Synchrotron.—In 1952, Courant, Livingston and Snyder, and independently, Christofilos, suggested how this might be done by introducing azimuthal variations into the magnetic field. Originally known as " strong focusing," their method is now referred to as the principle of " alternating gradient focusing." It may usefully be explained in terms of an optical analogy, illustrated in Fig. 11 (a). Two lenses of equal strength, one focusing and the other defocusing, are arranged as shown. The net effect of the system is to focus the incident rays.

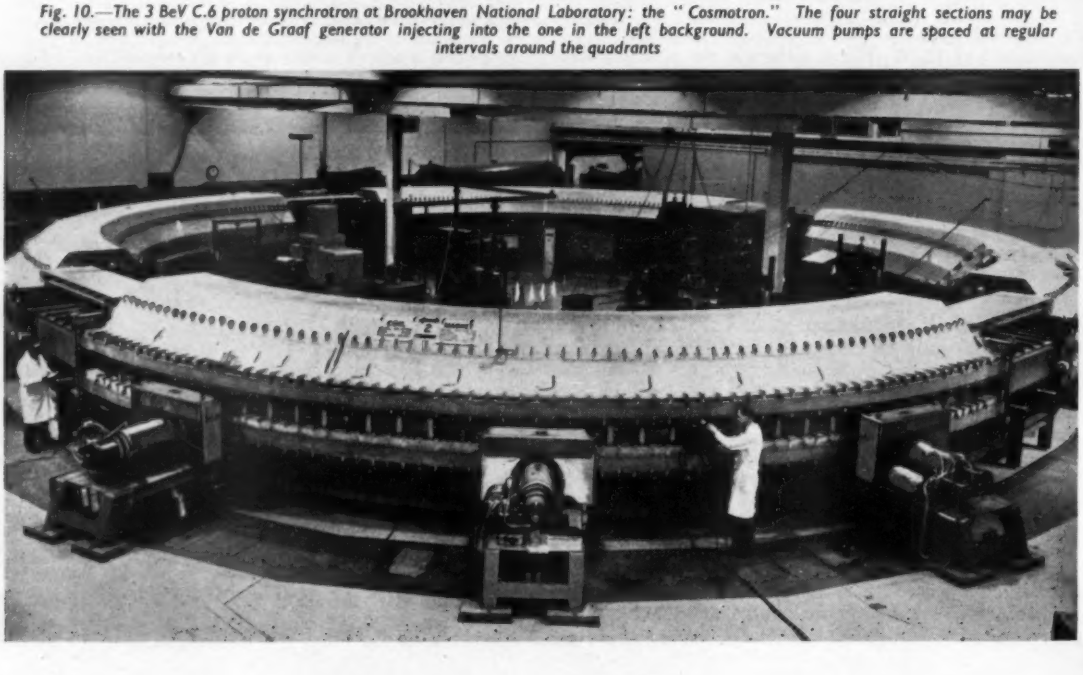
In the a.g. synchrotron, the guiding magnet is divided up into a large number of sectors in which n is large (of order 100); alternate sectors have positive and negative n. Thus, the sector with positive n is vertically focusing but radially defocusing; the next sector is vertically defocusing and radially focusing. Hence, in each plane the magnet system is analogous to a series of lenses. Each pair is a net focusing unit, and the overall effect is to focus the particles radially and vertically.

It may also be inferred from Fig. 11 (b) that if the strengths of the lenses are made too great, the system will " overfocus," with consequent growth in amplitude.

Particle oscillations in the a.g. system are described in terms of a parameter μ, the phase change of the oscillation per (F, D)-period of the field. For $\mu < 0$, the system is defocusing, for $\mu > \pi$, it is overfocusing. Plotting these " zero-mode " and " π-mode " lines in terms of the positive and negative n-values in adjacent sectors, we obtain the " necktie " diagram of Fig. 12. Inside the necktie, the system is stable in both planes. However, the introduction of straight sections changes the periodicity of the structure —the period now extends from straight section to straight section, rather than from one magnet pair to the next. This has the effect of introducing further unstable bands inside the necktie. Similarly, misalignments of the magnet sectors, and small errors in their fields, lead to more resonance regions. Hence, the large necktie is divided up into a number of smaller ones. The tolerances involved in preventing the selected " working point " from straying outside its small necktie are extremely severe. For example, in the 25 BeV a.g. proton synchrotron under construction at C.E.R.N., the central line of the magnet sectors must be set up around a circle of radius 100 metres $\pm 0{\cdot}3$ mm (see Fig. 13).

A direct result of the increased focusing is the phenomenon of " momentum compaction "; the equi-

Fig. 10.—The 3 BeV C.6 proton synchrotron at Brookhaven National Laboratory: the " Cosmotron." The four straight sections may be clearly seen with the Van de Graaf generator injecting into the one in the left background. Vacuum pumps are spaced at regular intervals around the quadrants



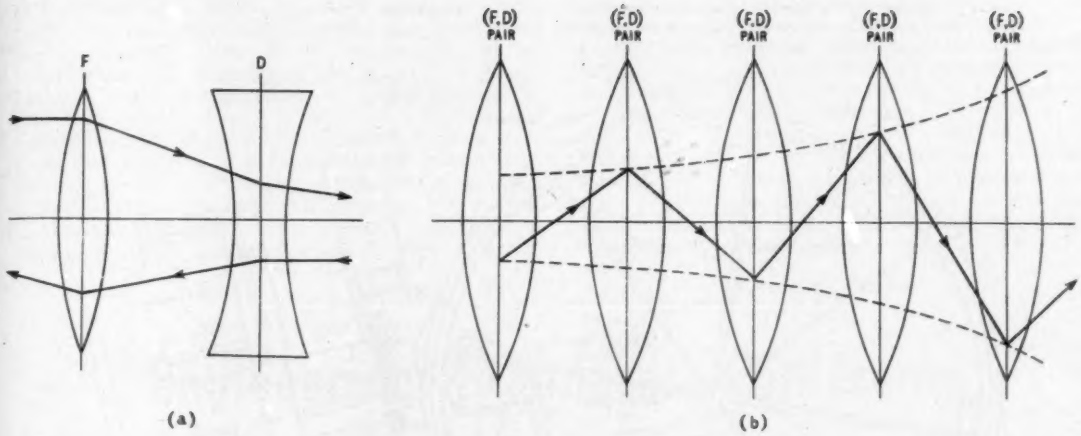


Fig. 11.—(a) Focusing system formed by a pair of thin lenses, one focusing, the other (b) " overfocusing " in the a.g. synchrotron

librium radii for particles of different momenta are packed much closer together than in c.g. machines. This has several undesirable consequences, chief among them being the occurrence of a " transition energy," and the difficulty of achieving more than " single-turn injection."

To explain transition energy, we recall our previous remark that the stable phase position in circular machines generally lies in front of the voltage peak of Fig. 5. This is not true of the initial stages of acceleration in the a.g. proton synchrotron. If a proton gains too much energy, it only swings out to a slightly greater mean radius, and its increased velocity causes it to complete one revolution in a shorter time than the synchronous proton. Thus, initially the phase picture is just as for the linear accelerator. However, when the protons become more nearly relativistic, a comparable energy gain leads to only a small velocity increase, and the increase in mean orbit length is the dominant effect. At the transition energy, the stable phase position switches over to the front of the voltage peak. Phase stability is momentarily lost, and if the beam loss is to be kept small, severe tolerances on the system are called for.

During injection, as the field rises and the protons gain energy, their mean radius moves inwards. With large momentum compaction this inward shift is very slow, and it is found that only those particles injected during one revolution time can be prevented from striking the back of the inflector. In c.g. machines, the number of injected turns is usually of order 100.

Thus, the introduction of a.g. focusing, whilst solving the economic problem of attaining proton energies in the range up to about 100 BeV, has brought a number of disadvantages in its train. Success has been achieved at the expense of beam current and considerably increased constructional complexity. At present, two a.g. proton synchrotrons for the 25-30 BeV range are under construction at C.E.R.N. and Brookhaven. The U.S.S.R. are building a 7 BeV machine to serve as a pilot model for a 50 BeV synchrotron. The a.g. focusing principle has also been applied to electron synchrotron design.

F.F.A.G. Accelerators.—The fixed field, alternating gradient principle stems from the basic principle used in a.g. machines—that correctly chosen azimuthal variations in magnetic field may be used to overcome the $0 < n < 1$ barrier. The f.f.a.g. goes further, in proposing that the increased momentum compaction be utilised to contain the entire proton energy range, from injection to full energy, inside the aperture of a d.c. magnet. The advantages of doing away with magnet recycling are manifold, and should lead to considerably greater beam intensities in the BeV range.

One form of f.f.a.g. machine, known as Mark I, would have reversed fields in alternate sectors, so that the equilibrium particle would alternately curve around, and away from, the machine centre. The scalloped nature of this " closed orbit " would lead to a greatly increased " circumference factor "—the ratio of path length to 2π times the mean radius. Hence the amount of steel required in a high energy machine would be very great.

In another type of f.f.a.g. accelerator—Mark V—the d.c. field would increase rapidly with radius in every sector, according to a power law, and vertical focusing would be achieved by providing spiral ridges on the pole faces.

However, the highly non-linear fields in spiral ridge machines lead to even more serious resonances in the particle motion than are encountered in a.g. synchrotrons. The introduction of straight sections, indispensable in practice, leads to a loss of " scaling " in the dynamics, and the working point can move into dangerous resonance regions. To overcome these difficulties, we are forced to consider " open sector " machines, in which the spiral

Fig. 12.—Stability " necktie " for a.g. synchrotron. The working region or " necktie " for an a.g. synchrotron shown together with the unstable bands that cross the stable region

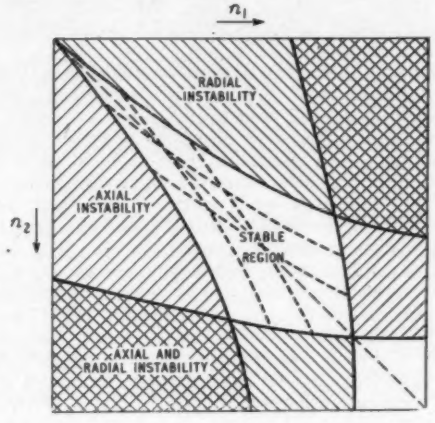
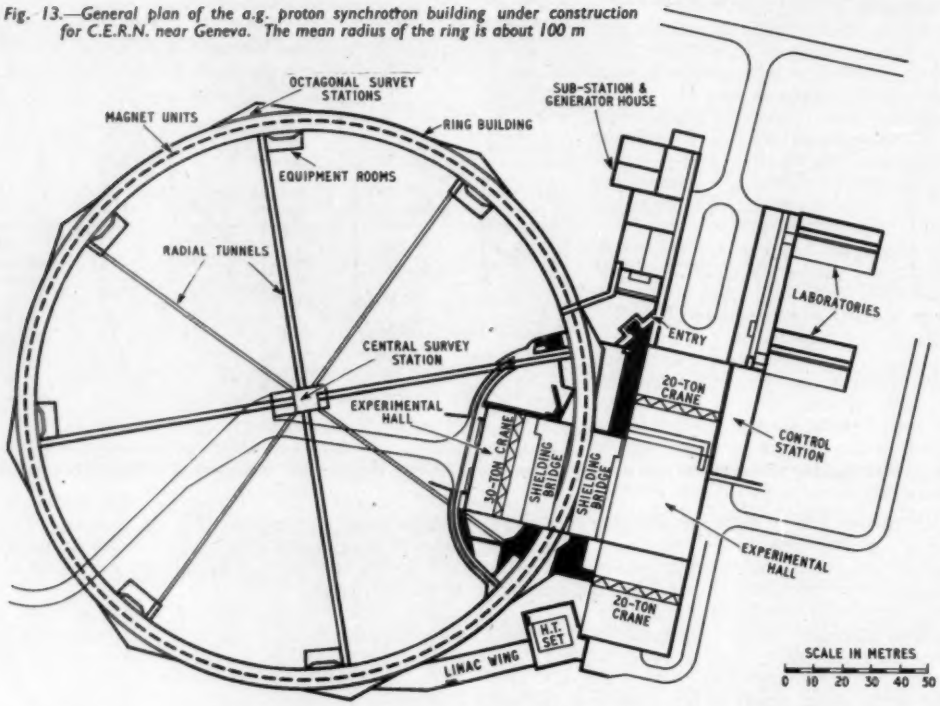


Fig. 13.—General plan of the a.g. proton synchrotron building under construction for C.E.R.N. near Geneva. The mean radius of the ring is about 100 m



ridges themselves form the magnet, with open, field-free regions between. Even then the straight sections must be kept uncomfortably short. It is not yet clear whether such a magnet structure is a practical proposition, and neither is it clear that the anticipated gain in intensity from such a machine justifies the exceedingly complex design.

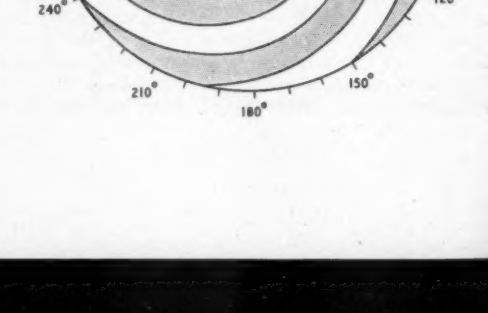
Bucket Lift, Beam Stacking and Synchrocrash.—Various methods of increasing the beam intensity in machines of this type are being examined—the so-called " bucket lift " and " beam stacking " schemes. Briefly, the object of bucket lift is to overcome the time waste during each frequency modulation cycle. For example, one such scheme would use several r.f. systems to accelerate many bunches of particles simultaneously. Beam stacking depends on the fact that high-energy protons may be left circulating in the vacuum chamber for relatively long periods, unaffected by radio frequencies different from their orbital frequency. Thus, the beam might be " stacked " while the r.f. is recycled to bring up another " bucket " of particles.

There are, however, a number of subtle complications to these schemes, and they must be examined much more thoroughly before they may be declared worth while. At the present time, the most promising approach seems to be stacking at full energy in order to build up a large circulating current before carrying out experiments.

In the " synchrocrash " proposal, two high-energy beams meet in head-on collision, thus providing large energies in their centre of mass system. The beams might be accelerated in two separate machines with a common target section, or, in a newer proposal, might be accelerated in opposite directions inside a single machine similar to the Mark I f.f.a.g. Once again, there are a number of serious objections to these schemes, and much more basic study has yet to be carried out. Most of the above ideas have originated with the M.U.R.A. group, who have embarked on extensive theoretical and experimental studies.

Spiral Ridge Cyclotrons.—The spiral ridge cyclotron is an offshoot of the f.f.a.g. proposals. Its purpose is to obtain vertical focusing by means of spiral ridges, whilst retaining the $n<0$ mean field law required for c.w. operation (see Fig. 14). Here again, resonances in the motion cause considerable difficulty and, in particular, prevent us from extending c.w. operation beyond about 900 MeV. However, the snags do not seem to be insuper-

Fig. 14.—Schematic plan of spiral ridge cyclotron pole face. The shaded regions represent ridges raised above the level of the main pole face. They provide vertical focusing necessary to overcome the defocusing due to the mean c.w. field variation. The sketch refers to a four-ridged machine to give 240 MeV protons at 50in radius



able, and several machines are under design in the United States. In this country, a theoretical design study for conversion of the 110in Harwell synchrocyclotron has been carried out. This would give a 240 MeV proton beam in nearly-c.w. operation, and would increase the present intensity by a factor of about 100. Experimental investigation of some of the problems unsuited to a theoretical approach is under way at the present time. Amongst the new accelerator proposals, that of the spiral ridge cyclotron seems closest to fruition.

Air-cored Magnets.—Another approach to the design of ultra-high energy machines is to dispense with iron magnets, and make use of the much higher fields attainable with air-cored systems. The consequent reduction in radius might then make these machines economically feasible. Once again a great many problems remain unanswered, but some designers feel that such accelerators are our best hope for the near future.

We have already mentioned the proposal of G. I. Budker, and shall not amplify our remarks here. Many of the difficulties involved appear to be insurmountable at the present time, but the scheme has aroused great interest. Budker accelerators may form a new generation of machines before the end of this century.

Engineering Standards Conference

THE fourth annual conference of engineers responsible for standards was held on Wednesday last week in London. The conference, which was attended by 250 delegates and sponsored by the Institution of Production Engineers and the British Standards Institution, was opened by Mr. F. J. Erroll, M.P., Parliamentary Secretary to the Board of Trade. He said that the Board of Trade was solidly behind the work of the B.S.I. and the Government subsidy had reached the maximum possible in the last year or two. The Board of Trade tried to ensure that orders placed by Government Departments specified equipment conforming with the relevant standards. He referred to international standards and the export trade and the controversial subject of the imperial and metric dimensional systems.

The report by the Standing Advisory Committee was introduced by the chairman, Mr. H. Stafford (chairman of the Institution of Production Engineers' Standards Committee). The function of the Committee is to advise the B.S.I. on questions concerning the application of standards. The report made reference to education and training courses in standards and the developments in this and other subjects that had occurred since the last conference. With regard to the export trade, the report stated that it was proposed to prepare a short booklet for the use of exporters giving information about the level and standing of British Standards, their conformity with international recommendations, etc. The Export Panel urged the need for manufacturers to give serious attention to providing overseas customers with well-presented technical information on standards.

The second item on the agenda referred to the effectiveness of United Kingdom participation in international standards work and was introduced by Sir Stanley Rawson, chairman of the Engineering Divisional Council, B.S.I. After the war, he said, industrial production had recommenced with a comparatively clean sheet and in many overseas countries standards were backed by the force of law. Consequently, it was difficult for Great Britain to impress the international standards conferences with her views unless really competent British engineers who also realised the importance of standards attended these conferences. Very great responsibility was placed on the delegates, who had sometimes to make individual decisions to reach agreement on some international standard. The decisions had far-reaching effects on equipment design and the export trade.

The implications for export trade of the use by the United Kingdom of the imperial and metric systems was introduced for discussion by Mr. H. G. Conway, director of Short Bros. & Harland, Ltd. Apart from the use of the metric system for the benefit of the export trade, Mr. Conway gave a very lucid account of the advantages of the metric system for general use in this country. But this item was not put on the agenda for the purpose of discussion of the merits of one system over the other. This country was bound to reckon with important export markets using either system and the intention therefore was to discuss how best industry should face the problem of having to work to two systems. Time would show whether the balance had been tipped so far that it would be to our advantage to face the major readjustments of a change to the metric system. No change in Government policy had been made known since the statement in 1952, following the report of the Hodgson Committee on weights and measures legislation, that the Government was not prepared to proceed with the recommendations for the abandonment of the imperial in favour of the metric system of weights and measures.

Item 4 on the agenda, on the implementation of British standards, was introduced by Mr. A. Parrish (I.C.I., Ltd.). This problem has been the subject of continuing concern. In all cases it has taken some time for a new standard to be established in production; three years has been suggested as a normal period. It had been suggested that the B.S.I. Technical Committee, when it had established a new standard, should in the light of its knowledge of the industry and the factors involved, fix a date following the publication of the standard by which supplies made in accordance with it should be, and could be expected to be, available. This might be a possible course in some cases but the B.S.I. did not consider it feasible or desirable as a general rule; there could be no mandatory force in such a date and there would seem to be difficulty in setting one with sufficient accuracy to avoid disappointment and dislocation. Among other matters discussed at the conference was the role of the standards engineer in industry.

Nuclear Power Engineering Course

A short residential course on nuclear power engineering will be held from 13th to 18th July at Clifton Hill House, Clifton Hill, Bristol, 8. The residential fee for the course will be £12 12s and the non-residential fee £7 7s. The course is being organised by the Regional Council for Further Education for the South West, 12, Lower Castle Street, Bristol, 1, from which further information can be obtained. Registrations will be accepted up to 7th June.

NEW BOOKS

Atmospheric Electricity. By J. A. Chalmers. Pp. 327; figs. 64. Pergamon Press, Ltd., 4 and 5, Fitzroy Square, London, W.1. Price 63s.

Two decades ago a subject of research for small groups of geophysicists, atmospheric electricity has since assumed major scientific and technical importance largely as the result of wartime requirements. To cite only one example, radar may be said to have been developed from an investigation of the radiation produced by lightning discharges and the modification of the resulting electromagnetic waves by the ionosphere. As a result of this development specialised journals have made their appearance and the literature on the subject has grown so rapidly that an urgent need has arisen for an English book summarising existing information.

In publishing the present volume Dr. Chalmers could utilise his earlier treatise published in 1949 which he has greatly expanded by incorporating the large amount of information on wartime and post-war achievements which has since been made available. He concentrates on the physical basis of the subject and deliberately excludes such large specialised technical problems as the propagation of electromagnetic waves which is of primary importance to the telecommunication engineer.

After a brief historical survey the essential physical parameters are introduced and the movement of ions is examined by which the state of atmospheric electricity is determined. The main chapters deal with the potential gradient and with the currents flowing between the lower atmosphere and earth, both in fine weather and in rain. Further chapters are devoted to thunderstorm and lightning phenomena and the survey concludes with an interesting summary of problems which require solution.

No detailed knowledge of atmospheric electricity is expected from the reader and the book can therefore be recommended as a useful introduction to the subject. The author adopts an almost colloquial style and the presentation is further simplified by sub-division into short sections which may be welcomed by the impatient reader who wants a quick answer without having to read through lengthy chapters, but which may appear somewhat distracting to the more studiously inclined. The book is well authenticated by over six hundred references so that it should save the reader a great deal of time in finding more detailed information although the author's own views on a variety of controversial theories and on alternative results of measurements would have been welcome. The reproduction and printing are of high standard.—R.H.G.

Electronic Measuring Instruments. By E. H. W. Banner. Pp. 395; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

Improvements in the design and reliability of electronic components and circuits have resulted in the use of electronic instruments for measurement and control purposes in nearly every branch of science. In spite of the varied nature of the physical quantities to be measured, the basic problem in the design of an electronic instrument is the choice of a suitable transducer such that the application of the quantity to be measured will produce a usable electrical output such as a voltage, a change in resistance or phase, or some other parameter which may be measured by an electronic circuit. Thus, the functions performed by the individual sections of an electronic instrument may be fundamentally classified as "detecting or sensing devices" and "measuring circuits."

Examples of the former include the thermistor and Geiger-Müller tube and of the latter, the valve voltmeter and frequency meter, etc. The author has adopted a somewhat different system of classification which leads to a certain amount of duplication; for example, similar types of electronic counters are discussed under the heading "radiation measuring instruments" and again under "electronic and related counters." The scope of the book is wide and contains descriptions of instruments from most branches of science, acoustics being the obvious exception. It is regrettable that a number of errors in the diagrams have recurred in the second edition of this book, a work which will undoubtedly appeal to both students and instrument users.—H.B.W.

Industrial Electronics. By Andrew W. Kramer. Pp. 311; figs. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 36s.

The preface defines this book as "primarily for those who have a good knowledge of general physics and engineering, but who have had very little training or experience in electronics." It is necessary to warn prospective readers that the book was published in the U.S.A. in 1949, and there are no signs of later revision.

The author starts by describing, in qualitative terms, the physics of free electrons and the fundamentals of valves. A group of chapters then deals with diodes, triodes and multi-grid tubes and their use as oscillators. There are then four chapters on gas-filled tubes, one on photocells and one on special tubes including klystrons and magnetrons. The rest of the book, about half the total, describes industrial applications. These include rectification, motor control, instrumentation, r.f. heating and lighting. The treatment is entirely non-mathematical but is well illustrated with clear diagrams.

It seems to me that the author has mistaken his audience, for the book would be quite suitable, though somewhat out of date, as an introductory course in electronics for laymen and schoolboys. If it is aimed at non-specialist engineers and physicists why not include enough mathematics to illustrate design principles? In fact, the book is quite clearly written and although any specialist could pick holes in it, it does give a respectable lay account of industrial electronics at the time at which it first appeared.—A.H.B.

BOOKS RECEIVED

Directory of Opportunities for School Leavers. Preface by Sir John Wolfenden. Pp. 180. Cornmarket Press, Ltd., 1, Lower James Street, London, W.1. Price 8s 6d.

Social History of Lighting. By William T. O'Dea. Pp. 254; figs. Routledge & Kegan Paul, Ltd., Broadway House, 68-74, Carter Lane, London, E.C.4. Price 42s.

Electrical Engineering Practice (6th Edition). By J. W. Meares and R. E. Neale. Pp. 716; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s.

A Guide to Nuclear Energy. By R. F. K. Belchem. Pp. 77; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Kingsway, W.C.2. Price 10s.

Network Synthesis. By David F. Tuttle, Junr. Pp. 1,175; figs. John Wiley & Sons, Inc. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price $23.50.

VIEWS on the NEWS

By REFLECTOR

IT is pleasing to see that electricity is now getting a fair amount of attention in B.B.C. programmes. There was a time when there seemed to be a bias in favour of another industry. In a news bulletin last week Mr. H. V. Pugh, chairman of the Eastern Electricity Board, was interviewed and put the case for electric block storage heating and floor warming. During the same evening, in the programme "The Common Room," some children were shown rehearsing, without "props," a scene from Thornton Wilder's "Our Town." One girl had to make the motions of using a cooker and in answer to a comment from the producer said that it was an electric cooker as she preferred that sort.

* * *

Criticism of the Yorkshire Electricity Board was contained in a letter to the *Telegraph and Argus* (Bradford). The writer complained that when the Board's meter readers were unable to gain entry to houses the Board sent in a bill based on the estimated consumption. He wanted to know why the Board did not employ the dial card system. To this the Board replies that "in general it has been found that dial cards create more problems than they solve." There is probably something in this because the number of dials, the anti-clockwise movement of some of the pointers, and the existence of the "tenths" dial all tend to confuse the consumer. From this aspect there is much to be said for the cyclometer type of meter.

* * *

The National and Local Government Officers' Association (N.A.L.G.O.) includes in its membership the staffs of both the gas and electricity supply industries. For this reason it has submitted a memorandum to the Committee which is examining the question of co-operation between the two industries. In the course of this, I am told, it refers to the unsettling effect which continued reorganisation has upon the staff. The opinion is expressed that co-operation in the "administration of services of a like kind" is likely to weaken the zeal and enthusiasm which, as the Ridley Committee found, resulted from competition between the two services. The Association says:—

> "It is probable that many consumers have decided to use gas or electricity not because they clearly prefer one sort of fuel to the other, but because they have been impressed favourably or unfavourably with the quality of service received in a service centre or showroom, or in dealings concerning accounts or other matters."

Several other reasons are adduced for opposing co-operation, even in the matter of joint meter reading, and the Association seems to be particularly against joint showrooms.

* * *

In the children's section of the *News Chronicle*, "Big Chief I-Spy, *News Chronicle* Wigwam," refers to the "electric eye" by means of which doors are opened and the lights at some pedestrian crossings are operated. He tells his little readers, "You can score 35 for this." I have often seen children scoring more than this with these fascinating devices.

* * *

That probably unique body, the Fixed Price Light Co., is in the news again. It will be remembered that this company, which was started nearly fifty years ago, undertakes for a fixed weekly charge to supply lamps and the electricity for them to "workpeople's" dwellings. I suppose that nowadays the arrangement provides for radio and television, too, and probably electric irons. Anyhow the case in question was one in which a man was charged with diverting and fraudulently consuming electricity. It was stated that he had been found to be using a 1,000 W fire when he had no right to do so. As I have said on previous occasions, this system appears to be a quaint survival from the early days of electricity supply. Surely there are few "workpeople" now who cannot afford to have a proper electrical installation and enjoy unrestricted use of electricity.

* * *

Many attempts have been made to frame a satisfactory definition of "automation." The latest I have seen occurs in an Indian electrical paper and it reads as follows:

> "By Automation is meant production by the use of automatics making the various processes continuous and sets of machines self-directed which can be said to eliminate the necessity of the Engineers' Brain in the details of production."

* * *

The Franco-British Exhibition at Shepherd's Bush was held fifty years ago and the *Electrical Review* described the electrical arrangements in its issue of 29th May, 1908. There was a load of about 3,000 kW, practically all lighting, supplied from two separate outside sources—the Kensington and Notting Hill Companies' Wood Lane station and the Hammersmith Borough Council. Those were the days of the inverted peak and the charge for electricity was 1d/kWh between sunrise and sunset and 2d during the remainder of the twenty-four hours. For the decorative lighting there were some 75,000 5 c.p. incandescent lamps and for general lighting about 1,500 arc lamps. One of the largest motors employed was the 150 h.p. machine operating the "Flip-Flap" (a curious device consisting of two enormous arms, at the upper ends of which passenger cages were suspended, that moved in a wide arc across each other). Apart from the general supply, some of the plant in the Machinery Hall supplied electricity; among this were a 1,500 kW Parsons turbo-generator and a 750 kW Westinghouse gas-engine set. Some of the Colonial pavilions also had their own electrical installations.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir Josiah Eccles, C.B.E., M.M., D.Sc., M.I.C.E., M.I.Mech.E., M.I.E.E., deputy chairman of the Electricity Council, has accepted the invitation of the Association of Supervising Electrical Engineers to succeed **Sir Harold Bishop,** C.B.E., F.C.G.I., B.Sc. (Eng.), M.I.Mech.E., M.I.E.E., as president of the Association. Sir Josiah will be inducted as president at the meeting of the Association to be held at the Institution of Electrical Engineers on 21st October.

Sir Josiah Eccles

The authors of the article "Particle Accelerators," Part 1 of which appears on page 1007, are **Mr. N. M. King,** M.Sc., B.Sc., and **Mr. A. J. Egginton,** B.Sc.

Mr. King graduated in 1952 with a first-class degree in physics from the Queen's University of Belfast. Turning to theoretical studies, he gained the M.Sc. degree for a thesis on atomic scattering problems. He left Queen's in late 1953 to go to Harwell, where he has worked on accelerator theory, specialising in particle dynamics. He has been chiefly concerned with the design of proton linear accelerators and, more recently, with the theory of spiral ridge cyclotrons. At the end of February he left to spend six months at the University of Florida, where he has been invited to participate in a spiral ridge cyclotron design project.

Mr. Egginton was educated at University College, London, where he took an honours degree in physics in 1951. He then spent two years on post-graduate research, working on an electron synchrotron at University College before moving to Harwell to join the newly formed Proton Linear Accelerator Group of the U.K. Atomic Energy Research Establishment, which he still serves. He is now engaged on magnet design for the 7 BeV proton synchrotron under construction at Harwell for the National Institute for Research in Nuclear Science. He has also taken a keen interest in the shielding and radiation problems of this accelerator.

Mr. N. M. King

Mr. A. J. Egginton

The United Kingdom Atomic Energy Authority announces the following new appointments in the Industrial Group:—**Mr. P. T. Fletcher,** formerly director of engineering, becomes a deputy managing director; **Mr. H. V. Disney,** formerly deputy director, defence plants, supplies and services, becomes director of engineering; and **Mr. R. V. Moore,** formerly deputy director, civil reactors, becomes director of reactor design.

Mr. L. W. Brown, B.Sc., Ph.D., M.I.E.E., F.Inst.P., has been appointed assistant chief electrical engineer (light current) of the Metropolitan-Vickers Electrical Co., Ltd., in addition to his present duties as chief engineer, Electronics Department.

Dr. L. W. Brown

Dr. Brown was educated at King's College, London, and obtained his B.Sc. and Ph.D. degrees working under E. V. Appleton on ionospheric research. After a period as a flight-lieutenant in the R.A.F. he joined the Telecommunication Research Establishment in 1940 and at Rugby collaborated in the first development in this country of centimetric radar. Later, with the B.T.H. Co., he continued the development of airborne, ground and marine radar equipment and in 1950 he joined the Metropolitan-Vickers Co. as chief engineer, Radio Department, to lead in the design of large surveillance radar equipment and was responsible throughout for the development of 3-D radar.

The General Electric Co., Ltd., announces that **Mr. S. Hack,** manager of its Plymouth branch since 1928, has joined the personal staff of Mr. W. J. Bird, home sales director of the company.

The Southampton and Plymouth branches have been joined under the overall managership of **Mr. D. E. Kidner,** formerly manager of Southampton branch. **Mr. J. T. Mellor,** A.M.I.E.E., of the Southampton branch, has been appointed manager of Plymouth branch in succession to Mr. Hack.

Mr. Hack has been with the G.E.C. for fifty-two years. Joining the Post Department of head office in 1906, he graduated through the counting house and the Invoice Department to the London Sales Department, from which he was appointed to the Plymouth managership.

Mr. Kidner joined the Cooker Department of the G.E.C. in 1937. After war service with the Royal Artillery he rejoined this department and was later transferred to London Sales Department until his appointment as Southampton manager in 1953.

Mr. Mellor was apprenticed at the G.E.C. Witton Works from 1940 to 1945. From there he transferred to the engineering sales staff at head office, joining the London Sales Department in 1949 and transferring to Southampton branch in 1951. He became branch engineer in 1953 and combined this post with that of sales supervisor in 1955.

Under the G.E.C. Scholarship Scheme, initiated in 1955, scholarships this year have been awarded to the following:—**Mr. T. W. S. Hoban,** Engineering Works, Erith, for a three-year course in mechanical engineering at a residential university; **Mr. I. M. Hobbins,** Staff Department, Head Office, for a one-year course in personnel management at the London School of Economics; and **Mr. R. A. Smith,** Union Works, Wembley, for a sandwich diploma course at a college of technology.

Mr. S. R. B. Brewer, B.Sc.(Eng.), A.M.I.E.E., has been appointed a director of the Bryce Electric Construction Co., Ltd. Mr. Brewer received his technical education at Queen Mary College, London University, and has been with the company for 22 years, being appointed sales manager in 1955.

Mr. S. R. B. Brewer

Mr. J. G. Rochester, A.C.W.A., financial controller of the Telegraph Construction & Maintenance Co., Ltd., and a director of eight of its subsidiary and associated companies, has retired. At a recent ceremony, Sir John Dean, chairman of the company, presented him with a silver salver on behalf of the directors. Mr. Rochester joined Telcon in 1935 as

Sir John Dean (right) presenting a silver salver to Mr. J. G. Rochester on his retirement from the Telegraph Construction & Maintenance Co., Ltd.

cost accountant at its Greenwich Works.

Mr. R. L. Elkington, C.B.E., Controller of the Export Licensing Branch of the Board of Trade, retired on 25th May. **Mr. R. Wood** has been appointed Controller as from that date.

Mr. G. F. Wylde has joined the Benjamin Electric, Ltd., as assistant manager of the Radio Department. Mr. Wylde was for five years with the Telecommunications Research Establishment (now the R.R.E.), and then for three years he was attached to the R.A.E., Ambarrow Court, Farnborough, followed by a similar period with E.M.I. Engineering Development at Hayes, as components liaison engineer. He then became sales engineer with the McMurdo Instrument Co., Ltd., where he remained for three years before joining Benjamin Electric.

Mr. G. F. Wylde

As 1958 is Festival Year in Wales, and since the chairman of the **I.E.E. Utilisation Section,** Mr. J. Vaughan Harries, is the first Welshman to be elected to this office, it was particularly appropriate that the Section should join forces with the I.E.E. Western Centre for a joint summer visit to Porthcawl, in South Wales. This was held from 16th to 18th May, when 140 members and ladies from all parts of England and Wales took part in a weekend programme of social functions and visits. On Friday evening they were the guests of the Brush Electrical Engineering Co., Ltd., at a dinner and dance at the Seabank Hotel. Mr. J. H. R. Nixon, technical director of the company, presided. Both Mr. J. F. Wright (chairman of the Western Centre) and Mr. J. Vaughan Harries expressed thanks to the company for its generous hospitality.

On Saturday morning most of the members visited the Abbey Works of the Steel Company of Wales, Ltd., at Port Talbot, while most of the ladies chose the alternative visit to the fourteenth-century St. Donat's Castle at Llantwit Major. In the evening the participants were guests of the South Wales Electricity Board at an informal reception and dinner at the Seabank Hotel. Sunday morning was devoted to a coach tour of the mountains and valleys of the Rhondda.

In the House of Commons last week Mr. Harmar Nicholls announced that the Lord President of the Council had decided to set up a committee "to inquire into the techniques employed by Government Departments, and other bodies wholly financed by the Exchequer, for the management and control of research and development carried out by them or on their behalf, and to make recommendations." The membership of the committee is as follows:—**Sir Claude Gibb,** K.B.E., D.Sc., F.R.S., chairman and managing director, C. A. Parsons & Co., Ltd. (chairman); **Dr. Willis Jackson,** F.R.S., director of research, Metropolitan-Vickers Electrical Co., Ltd.; **Dr. R. P. Linstead,** C.B.E., F.R.S., Rector, Imperial College of Science and Technology; **Mr. A. A. Part,** M.B.E., Ministry of Education; **Sir Solly Zuckerman,** C.B., F.R.S., Birmingham University; and **Mr. D. Neville Jones** (secretary).

Mr. J. H. Ross has been appointed managing director of Chamberlain & Hookham, Ltd., in succession to **Mr. J. S. Carter,** who has retired. Mr. Carter, who has been managing director for the past twenty-one years, recently completed fifty years' service with the company.

Mr. Ross, who was elected to the board of the company last year, has been sales manager for the past eight years. Before that he was principal assistant to the sales manager of the Instrument and Meter Department of the Metropolitan-Vickers Electrical Co., Ltd.

Mr. R. Lott, A.M.I.E.E., A.M.Inst.F., has been appointed superintendent of the Blyth "A" power station of the North Eastern Division, C.E.G.B. Mr. Lott served a general apprenticeship with the South Wales Electric Power Co. and after service at the Upper Boat and Llynfi power stations he was with the South East Scotland Division of the B.E.A. from 1948 to 1954. He was appointed deputy power station superintendent at Dunston "A" and "B" and Blaydon power stations of the North Eastern Division in 1954, leaving there in 1956 to take up the position of superintendent at the Portobello power station of the South of Scotland Electricity Board.

Mr. R. Lott

Ferranti, Ltd., announces the retirement on 26th May of **Mr. F. Hope,** chief test engineer of the Transformer Department. Mr. Hope joined the company 46 years ago and since 1935 has been in charge of the test and inspection of large transformers. **Mr. K. Ripley** succeeds Mr. Hope as chief test engineer of the Transformer Department.

Mr. E. Asquith, A.M.I.E.E., at present commercial engineer of the Castleford District of the Yorkshire Electricity Board, has been appointed commercial engineer of the South West Essex District of the Eastern Electricity Board in succession to **Mr. R. Walker,** who was recently appointed manager of the Board's Chelmsford District.

Mr. E. Asquith

Mr. Asquith was educated at the Dewsbury Technical College and the Leeds College of Technology and received his training with the Yorkshire Electric Power Co.; he later became an assistant installation engineer with Electric House, Ltd. He served with the R.A.O.C. and R.E.M.E. during the war and in 1949 was appointed installation engineer in the Castleford District of the Yorkshire Board and consumers' engineer in the same District in 1951, a position which he held for two years.

Mr. H. Watson-Jones has been appointed managing director of Richardsons, Westgarth (Hartlepool), Ltd., and elected to the board of the parent company, Richardsons, Westgarth & Co., Ltd., with effect from 1st June. **Mr. T. P. Everett,** hitherto managing director at Hartlepool, has become executive director of Richardsons, Westgarth & Co., Ltd., on atomic business, based in London with **Mr. H. Fothergill,** the company's consultant on atomic affairs. **Mr. J. O. M. Fisher** relinquishes the managing directorship at the Humber Graving Dock & Engineering Co., Ltd. (a subsidiary of Richardsons, Westgarth) on 30th June on reaching retirement age, but will continue to be a director. **Mr. A. A. E. Wise,** at present works director, becomes managing director.

The annual general meeting of the **Ipswich and District Electrical Association** was held at Electric House, Ipswich, on 19th May. Mr. R. A. Jackson (chairman) said the Association had had a successful year, with the membership increasing by 19. The various functions and activities of the Association had been well supported, and the numbers attending both the annual dinner and the ladies'

Ipswich and District Electrical Association annual general meeting; Mr. R. A. Jackson, retiring chairman, investing Mr. A. White, chairman, with the chain of office. Also in the photograph are, left to right, Mr. W. F. Rowberry (secretary), Mr. J. A. Robertson (vice-chairman) and Mr. R. W. C. Stebbings (chairman of the Lecture Committee)

evening were once again a record. Following the address, the election of officers took place. Mr. A. White (branch manager, General Electric Co., Ltd., Ipswich) was elected chairman for the ensuing year, Mr. J. A. Robertson (assistant chief engineer, Bexford, Ltd., Manningtree), vice-chairman, Mr. W. F. Rowberry (Siemens Edison Swan, Ltd., Ipswich), hon. secretary, Mr. W. H. Howell (Eastern Electricity Board, Ipswich), hon. treasurer, and Mr. H. H. Wright (Metropolitan-Vickers Electrical Co., Ltd., Ipswich), hon. publicity and press relations officer.

Due to his recent transfer to the Electricity Council, Mr. C. T. Melling resigned from the presidency of the Association and he is to be elected an honorary life member in recognition of his services. Mr. H. C. Waters, J.P., M.I.E.E., F.R.S.A., ex-deputy chairman of the Eastern Electricity Board, has accepted the office of president.

Mr. S. F. Smith has recently taken up an appointment as sales manager of the Industrial Instruments Division of Firth Cleveland Instruments, Ltd., Treforest, Glamorgan. Mr. Smith, who was previously with Philips Electrical, Ltd., will operate from the Sales Department, Byron House, 7-9, St. James's Street, London, S.W.1.

The Southern Area tournament of the **Electrical Industries National Golf Championship** will be held at Brockenhurst Golf Club, Brockenhurst, Hants, on 16th July. The competition is open to all concerned in the electrical industry in the area comprising Hampshire, Dorset, Wiltshire and that part of Berkshire and Oxfordshire coming within the Southern Electricity Board's Area. Entries will be taken on the day but intending competitors are requested to notify their entry to the Southern Area hon. secretary, Mr. L. G. Chittenden, Whitworth Electric Co., Ltd., Devonshire Square, Southsea, Hants.

Proposing the health of the guests at the annual dinner of the Southampton branch of the **Association of Supervising Electrical Engineers** at the Palm Court Ballroom, Southampton, the chairman, Mr. A. J. Pearson, welcomed Mr. A. Brown, chairman of the Southampton branch of the Electrical Contractors' Association, and Mrs. Brown, who is chairman of the Southampton branch of the Electrical Association for Women, Mr. R. J. Webb, chairman of the Bournemouth branch of the A.S.E.E., and Mrs. Webb, and Mr. Harley, chairman of the Portsmouth branch, and Mrs. Harley. Replying on behalf of the guests, Mr. Brown referred to the combined lectures which had been arranged for the mutual benefit of members of the A.S.E.E. and E.C.A.

An effective appeal on behalf of the Electrical Industries Benevolent Association was made by Major R. Jordan and gifts presented by local business houses were competed for during the evening in aid of the Association.

Mr. E. W. Tandy has been appointed a director of J. Day & Co. (Derby Works), Ltd.

The annual dinner and reunion of the **Cromptonian Association** is being held to-day (Friday) at the Connaught Rooms, London. The guest of honour will be Mr. D. W. Fry, M.Sc., M.I.E.E., deputy director, Atomic Energy Research Establishment, Harwell.

The annual cricket match between the Royal Commercial Travellers' School and the **Electrical Trades' Commercial Travellers' Association** will be held on 7th June (3 p.m.) at Hatch End.

OBITUARY

Lt.-Col. H. W. Watts.—The death occurred recently, at the age of eighty-two, of Lt.-Col. Herbert W. Watts, M.I.E.E., M.I.Mech.E., who from 1925 to his retirement in 1941 was borough electrical engineer of Epsom and Ewell.

Col. Watts received his technical education at the City and Guilds Institute and Finsbury College, London, and served his apprenticeship with James Swinburne & Co. and Simpson Strickland & Co. After a varied experience with a number of electricity supply authorities he was appointed, in 1899, as chief engineer and manager to the Alderley & Wilmslow Electric Supply Co., where he erected and managed the works. Two years later he joined the Urban Electric Supply Co. as chief engineer and manager of the Weybridge, Walton-on-Thames and Hersham electricity works. In the 1914-18 war he saw service both in India and in this country. In 1919 he again went to India where he held the appointment of acting civil engineer assistant to the Director of Ordnance Factories, India, and other posts. Col. Watts returned to this country in 1922 and later went to Epsom.

Mr. C. W. Piggott, of Piggott & Whitfield, Ltd., electrical contractors and retailers, Stockport, died on 16th May. Mr. Piggott, who was connected with the electrical industry for fifty-eight years, was apprenticed in 1899 to McClure & Whitfield, Mersey Dynamo Works, Stockport. After a short time on the manufacturing side of the business, his interest centred on contracting and before the 1914-18 war he became manager of the Installation Department, for the development of which he was largely responsible. He held this position until 1946 when a reorganisation took place in McClure & Whitfield and Mr. Piggott and Mr. J. N. Whitfield formed Piggott & Whitfield, Ltd. Mr. Piggott was chairman of the Stockport branch of the E.C.A. for many years and a member of the N.W. Counties Section Board.

Mr. W. H. Walton.—By the death of Mr. Walter Henry Walton on 23rd May, in his ninetieth year, the electrical contracting industry loses one of its most prominent members. He was founder and chairman of Pinching & Walton, Ltd., London, and was president of the Electrical Contractors' Association in 1928-29. For fifteen years, up to 1947, he was chairman of the Association's Executive Committee.

The late Mr. W. H. Walton

WILLS

Mr. G. H. Fletcher, O.B.E., M.I.E.E., M.I.Mech.E., consulting engineer to the Traction Department of the General Electric Co., Ltd., formerly of the Metropolitan-Vickers Electrical Co., Ltd., who died on 20th December last, left £22,368 gross (£21,337 net).

Mr. H. Pepper, late assistant engineer on the staff of the Yorkshire Electricity Board, in the Calder Valley area, who died on 9th December last, left £3,144 gross (£3,074 net).

Mr. E. A. Holland, district commercial engineer at Barnsley with the Yorkshire Electricity Board, who died on 25th January last, intestate, left £2,685 gross (£2,617 net).

Mr. J. T. Grassie, formerly managing director of Lawson, Turnbull & Co., Ltd., electrical factors, Aberdeen, who died on 7th February last, left personal estate in England and Scotland valued at £32,391.

Mr. F. J. T. Cook, of Worcester, electrical engineer and contractor, who died on 16th January last, left £5,417 gross (£5,347 net).

Mr. A. G. Forgan, deputy superintendent at the Rotherham power station, who died on 12th January last, intestate, left £13,365 gross (£13,318 net).

PARLIAMENTARY REPORT

DURING the committee debate on the Finance Bill an amendment designed to reduce purchase tax on cathode-ray tubes, radio-gramophones and player pianos from 60 per cent to 30 per cent was moved by Mr. John Rankin, who criticised the high profits made from the sale of cathode-ray tubes.

Sir Harry Hylton-Foster, Solicitor-General, said that the Government believed there were sound reasons for taxing the tubes at the same rate as the television sets into which they went. If the cathode-ray tube could be sold separately and then attached to the set at some later stage there could easily be a means of avoiding purchase tax if the rates were different.

Mr. Harold Wilson said the Chancellor would earn the gratitude of many pensioners and families if he could ensure that people did not pay tax on what were second-hand tubes and which ought not to be taxable, and if he would deal with the "racket" in television servicing of putting in tubes described as "new" which were not. One way in which he could deal with it would be by making a conditional reduction in purchase tax.

The amendment was negatived.

An amendment to exempt oil heaters from the new 30 per cent tax was withdrawn after Mr. Amory had said he could not agree that to put oil, gas and electricity heaters in the same category was unfavourable to any section of consumers.

Technological Training

Mr. J. E. S. Simon, Financial Secretary to the Treasury, informed Mr. MacPherson that there were now eight designated Colleges of Advanced Technology and 40 recognised courses for the Diploma in Technology which were equivalent to honours degree courses. Some 1,360 students were taking a diploma course and the number of students in their first year was nearly double those in their second year. A further 21 courses had been recognised for next September. That should lead to a 50 per cent increase in the number of first-year students.

New Cable Ship

Mr. Marples, Postmaster General, informed Mr. C. R. Hobson that the Government had decided to build a new cable ship, and they hoped to place the order for it before the end of the year.

Telephone Developments

In an announcement about reductions in charges for telephone calls, Mr. Marples said that some subscribers—first those in Bristol—would soon be able to dial their own trunk calls to anywhere in this country. Because of the saving in labour, the charges would be reduced. For example a three-minute call over 125 miles would cost 2s 6d against 3s 6d now. Local calls in areas with subscriber trunk dialling would be timed. Instead of 3d untimed, they would be charged at 2d for three minutes in the ordinary period and 2d for six minutes during the cheap rate period. These new charges would start in Bristol on 1st December next. They could not be applied elsewhere until equipment was installed to enable subscribers to dial trunk calls. A new coin box to enable trunk calls to be dialled from kiosks would be introduced later.

A White Paper gave the information that the trunk dialling system would be extended to 46 other towns by the end of 1960.

Mr. C. R. Hobson said that the whole House wished to pay tribute to the Post Office engineers who had made this development possible.

Railway Investment

Mr. Harold Watkinson informed Mr. Ernest Davies that, on certain understandings, the Government was prepared to authorise additional investment in railway modernisation of £25 million for the two years 1958 and 1959. This would make the total investment for the two years about £15 million more than the original estimates before the cuts but less than the totals forecast in the regional budgets produced subsequently. There had been no change in the date forecast for the completion of the modernisation plan. Much of it was well ahead of schedule and the object of the increased capital investment which the Government was now prepared to authorise was to accelerate the more immediately remunerative items.

Engineering Industry Joint Consultation

Mr. Leavey asked the Minister of Labour what steps he had taken to ascertain whether employers and trade unions in the engineering and shipbuilding industries were proposing to set up a National Joint Council in their industries as recommended by the courts of inquiry in their reports of April, 1957.

Mr. Iain Macleod, in a written reply, stated that the Engineering Employers' Federation considered that existing procedure for the avoidance of disputes worked satisfactorily and the Shipbuilding Employers' Federation also felt that the existing arrangements should continue to operate. The Confederation of Shipbuilding and Engineering Unions repeated the statement made at the courts of inquiry that they considered that the setting up of such a body with wide terms of reference would be advantageous to the industry.

While he regretted that the suggestion made originally by the court of inquiry in 1954, for the engineering industry, and reinforced by the courts of inquiry in 1957 for both industries had been rejected, it was, of course, for the organisations themselves to agree upon machinery for the discussion of wages and other conditions of employment, as well as other matters of joint interest affecting the productive efficiency of the industries.

Steam Boilers

Replying to Mr. Leavey, the Minister of Labour (Mr. Iain Macleod) said he had decided to appoint a committee to consider the existing legal provisions concerning the examination of steam boilers in the light of modern developments in design and construction, the size of units installed and the use of nuclear reactors as a source of heat, and to advise him of any changes which appeared desirable. The membership of the committee would be Mr. George Gordon Honeyman (chairman), Professor J. M. Kay, Mr. R. Munton, Mr. G. Robinson, Mr. W. M. Tallon and Mr. J. L. B. Garcia (secretary). The report of the committee would be most valuable to him in reaching a decision on whether the law needed changing.

Collaboration with Euratom

Sir James Hutchison asked the Home Secretary if he was in a position to make a statement about the possibility of this country's entering into some form of relationship with Euratom.

Mr. Butler said the Prime Minister had suggested to the President of the Euratom Commission that until Euratom had selected its permanent headquarters the head of the United Kingdom delegation to the High Authority of the Coal and Steel Community should also be accredited to the Euratom Commission. He had also proposed that we should negotiate a technical collaboration agreement which would provide the necessary framework for collaboration between the Government and the Community. He understood that these proposals had been welcomed by the Euratom Commission.

The proposed technical collaboration agreement referred to would be complementary to the general co-operation on nuclear affairs within Western Europe as a whole which was the task of the newly established European Nuclear Energy Agency of the Organisation for European Economic Co-operation.

Telling Britain's Story

WHEN the Canadian Trade Mission were here in the autumn they expressed surprise at the "miracle" of Britain's recovery from the war. The modern factories and advanced methods of operation, the quality of research, the skill and productivity of British labour, and the "ceaseless energy of purpose" on which they commented in their report had apparently not been expected. Such was our failure to tell Britain's story in North America. It is therefore pleasant to be able to welcome a resounding blast on the British trumpet in the form of the *Annual Review of British Industry* (Allan Wingate, price 42s), which has been prepared by the Economist Intelligence Unit.

Within the compass of 100 pages, even though these are quite large, it is impossible to do justice to every aspect of British scientific and industrial achievement. But by judicious selection, a concise and well-written text, and many excellent photographs, this book succeeds in its main aim of showing that Britain is one of the most up-to-date manufacturing countries in the world. It does not, perhaps, quite succeed in conveying the size of our efforts, and too much valuable space is devoted to personalities.

The opening article surveys British contributions to industrial and scientific progress, and in answer to those who consider that Britain does not know how to exploit her own inventions, it is pointed out that one-seventh of British exports are products that were not made before 1947. The article on "Britain Works Hard," which favourably compares British investment and productivity with those in other countries, could be read with advantage by many people in this country. Various capital and consumer goods industries are next dealt with separately, but there is regrettably no mention of domestic electrical appliances. Finally, there is an admirable article on the financial and commercial services provided by the City of London.

This edition is directed at the North American market, and particularly the United States. But in many ways this will make it even more effective in other markets where Britain's efforts have been overshadowed by the flood of propaganda from American manufacturers. It is to be hoped that British manufacturers will ensure that their overseas agents and representatives have copies of this book for display in their offices.

Control Engineering

THE place of instrument technology in control engineering provided the text of Sir Harold Hartley's presidential address on 20th May to the Society of Instrument Technology. In this he contended that control engineering now justified recognition as a primary technology which had made possible many of the most impressive developments in recent years. Its foundations were mathematical theory, electronics and new methods of measurement. It must become an independent discipline in engineering schools to enable the control engineer to be accepted as a member of a product team, so that control should be taken into consideration as a basic element in the design stage and not as something that could be added later.

Control engineering demanded a knowledge of certain branches of mathematics with which other branches were usually unconcerned, such as statistical theory and probability, non-linear differential equations and numerical methods applicable to digital computers including data processing. Undergraduate training needed in the first two years a grounding in fundamental physics and mathematics, as in every branch of engineering, provided it included some chemistry and some options. In the last two years more specialised aspects would be included to be followed by experience gained in industry.

The feasibility and success of a control system depended ultimately on instrumentation, which included the transmission of measurements to the control units. The cost might be high, but could be reduced by special designs covering only the small range required for any specific purpose instead of a general purpose instrument of the research type. A simple example was the control of a rolling mill in which sheet thickness could be measured continuously by X-ray absorption and any necessary adjustment signalled to the screw-down motors. On the other hand, adjustment of chemical composition involved a number of independent variables, which required investigation of the dynamics of the processes concerned. Progress had been greatly advanced in complex industrial applications by data logging in a central control room. The logger, in addition to each signal against low and high limit signals and indicating normal values, would record the output data in digital form, thus acting as a central recorder.

Prior to the presidential address the Bowen Prize was presented by Mr. P. Goudime (president of the Scientific Instrument Manufacturers' Association of Great Britain) to Mr. S. T. Lunt for his paper on "Process Development and Plant Design—the Role of Instrumentation with Particular Reference to the Application of Computers."

Atmospheric Pollution

AT a joint meeting of the Royal Meteorological Society and the National Society of Clean Air on 13th May, Mr. R. G. Veryard (Meteorological Office) said that sunlight was reduced owing to smoke by up to 50 per cent in London during the winter months and that rainfall was likely to be heavier over large urban areas than in the countryside. There was more danger of heavy smoke concentrations in London with easterly winds than with the prevailing south-westerly winds.

Mr. C. J. Regan (D.S.I.R.) stated that about 3,000 instruments were in use in this country for measuring smoke and sulphur oxides, mainly on a monthly average basis. There was, however, a need for such measurements at daily or even shorter intervals. More research was required into the toxic effects of motor-car exhaust gases. Atmospheric radioactivity was discussed by Mr. N. G. Stewart (U.K.A.E.A.) and smokeless zones and control areas by Dr. W. C. Turner (M.O.H., Poplar). Chairmen of the meeting, successively, were Dr. R. Lessing (president of the National Society for Clean Air) and Professor P. A. Sheppard (president of the Royal Meteorological Society).

Solids in Flue Gases

PARTICULARS of sampling equipment for separate determinations of grit, dust and smoke in flue gases have been given to the Institute of Fuel by P. G. W. Hawksley, S. Badzioch and J. H. Blackett (British Coal Utilisation Research Association). In its simplest version the equipment consists of a dust-collecting cyclone, 1½in diameter, used as a flow meter, which is inserted into the gas stream at the end of a probe. At sampling rates above 5 cu ft/min at n.t.p. its function is to collect all dust particles above 5 to 10 microns. Grit particles above 76 microns (200 B.S. mesh) are separated by sieving. For collecting smoke particles (below 5 to 10 microns) the cyclone is backed by a glass-wool filter.

INDUSTRIAL NEWS

Cable-Makers' Holiday Pay

The Joint Industrial Council for the Electrical Cable Making Industry informs us that in addition to the holiday payments already prescribed, employees remunerated on systems of payment by results are to receive 10 per cent of the appropriate standard day time rates. Employees who normally receive lieu bonuses, blanket or all-in bonuses or other additional rates commonly applied over and above standard day time rates, excepting overtime and shifts premiums, will receive in their holiday pay the appropriate proportion of such additional payments or 10 per cent of the standard day time rates, whichever is the less. Where payments in addition to standard day time rates are already made in respect of holidays, they are to be absorbed in the revised scheme of holiday pay. The standard day time rates remain the "fall-back" rates for those remunerated on systems of payment by results. The agreement applies to annual holidays for 1958 and thereafter, and for statutory holidays commences with the payment for this year's August Bank Holiday.

Electric Heating Exhibition

Electrically-run homes using power at off-peak periods would have a great future, said Sir Ronald Thomson, a member of the South of Scotland Electricity Board, when he opened in the George Street Service Centre, Edinburgh, on 21st May a "Heating by Electricity" Exhibition. Sir Ronald said the Kirkcaldy Town Council had given local authorities a splendid lead with its blocks of all-electric flats, and Dundee and Edinburgh were following Kirkcaldy's example. The Scottish Special Housing Association also had plans for such houses on a large scale in the West of Scotland, and was to make its future houses of four storeys and over all-electric. This system had proved so successful with the present homes that the Association might also consider its application to smaller buildings. Peebles County Council intended to convert all schools in the county to an all-electric basis.

The exhibition, which will remain open for at least two months, demonstrates electric heating methods for the home and the business premises. Visitors can see underfloor heating cables, thermal carpets, and a heated door.

Railway Cable Contract

W. T. Henley's Telegraph Works Co., Ltd., has received further contracts from the British Transport Commission for supplying 6,000 yd of 0·15 sq in 25 kV single-core solid type cable for British Railways, Eastern Region (Colchester-Clacton-Walton), and 24,000 yd of 0·20 sq in 25 kV single-core solid type cable for British Railways, London Midland Region (Crewe-Manchester). These contracts cover the supply of all straight through joints and outdoor sealing ends in addition to the cable.

Merseyside Lighting Services Committee

Design of the domestic electrical installation around the ring circuit is going ahead and, it is anticipated, will be the subject of a final report this year, states the annual report of the Merseyside Electric Lighting Services Committee. During the year consideration was given to ways and means of providing a type of electrical installation which would permit additions and amendments to be made quickly, easily and cheaply. An approach was made to the Institution of Electrical Engineers for a ruling regarding the connection of lighting fittings to ring circuits. The Institution agreed that "provided the appropriate type of fused plug is used, and the fuse of appropriate rating inserted, the use of lighting fittings with ring circuits is thus entirely admissible . . ." On the basis of this ruling work was going ahead.

Consideration had been given to the contribution the Committee might make to the jubilee celebrations of the Illuminating Engineering Society in 1959. The chairman of the Merseyside E.L.S.C. is Mr. G. L. Butler (Illuminating Engineering Society); vice-chairman, Mr. C. C. Smith (Liverpool city lighting engineer); secretary, Mr. A. Wilcock (British Lighting Council); treasurer, Mr. T. Armstrong (electrical wholesaler). The committee is composed of representatives of M.A.N.W.E.B., E.C.A., I.E.S., electrical wholesalers and other parties.

Dounreay Start Up

Early on Saturday morning the Dounreay enriched uranium reactor became "critical." This reactor, which will ultimately develop 10 MW, is to be used primarily for testing materials for use in atomic power stations.

Air Conditioning Equipment for Hungary

Mr. A. Lakatos, general manager of the Wilhelm Pieck Railway Carriage Works at Gyor, Northern Hungary, came to London recently in connection with the ratification of an agreement, after two years of negotiation, between Hungary and J. Stone & Co. (Deptford), Ltd., for the supply of air conditioning equipment to be fitted in all types of main line railway coaches and railcars made in Hungary. J. Stone & Co. are to supply 100 complete sets of equipment, after which it is intended to develop joint manufacture of further equipment under licence.

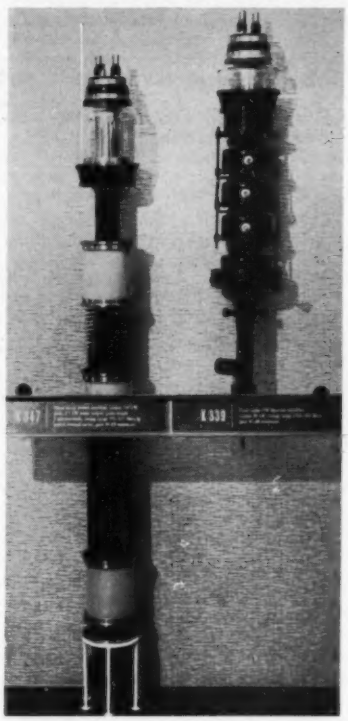
Industrial Fuel Efficiency

The 1958 Industrial Fuel Efficiency Exhibition will be held at Olympia, London, from 24th September to 3rd October. In addition to the exhibition a series of conferences have been arranged by the Institute of Fuel. The organisers are Provincial Exhibitions, Ltd., City Hall, Deansgate, Manchester, from whom particulars of stand space and other details can be obtained.

Enamelled Winding Wire Data

Two useful slides have been produced by Connollys (Blackley), Ltd., which give technical information on their enamelled and "Conymel" wire. Fitting easily into the pocket, these slides are made of indestructible, wipe-clean plastic and give such information

Two of the microwave valves shown by the English Electric Valve Co., Ltd., in London last week. The model K347 (left) is a three cavity pulsed, air-cooled klystron for high power long range surveillance and ground control of aircraft; the model K339 (right) is a CW klystron used in tropospheric scatter for long range communication or over mountainous terrain



as weight of wire per 1,000 yards, turns/inch, ohms/cu in, ohms/lb at 20 deg C and resistance temperature correction factors for h.c. annealed copper wire. They are available free on request from the company's Wire Division Sales Office, Kirkby Industrial Estate, near Liverpool.

British Participation in Canadian Show

In conjunction with the Board of Trade, the Birmingham Engineering Centre is organising a British engineering exhibit at the National Industrial Production Show of Canada to be held in Toronto from 4th to 8th May next year. Further details can be obtained from Mr. A. J. Cox, general manager, Birmingham Engineering Centre, Stephenson Place, Birmingham, 2.

Canadian Reactor Shuts Down

It is reported that a fuel rod caught fire this week at the Chalk River, Canada, atomic energy establishment with the result that radioactive dust spread throughout the reactor building. The plant is to remain shut down until the building has been thoroughly cleansed. There were no casualties and the staff are continuing to work in the building.

Switchgear Exhibition

J. A. Crabtree & Co., Ltd., are holding an exhibition of their products at the Grand Hotel, Sheffield, 1, from 9th to 14th June. They will be exhibiting particularly their type B-15 and B-16 air-break contactor gear and type D-6 manual starters together with such auxiliary equipment as remote control devices, limit switches and the like and wiring accessories, including their latest "Closegang" range. Applications for tickets should be addressed to the company at 32, Park Cross Street, Leeds, 1.

L.E.B. Floor Heating Installation

Off-peak electric floor heating controlled by a time switch and 150 A contactors has been installed in the new heavy plant store of the London Electricity Board at Mollison Avenue, Brimsdown, Middlesex. The main store, which is 255ft long by 80ft wide and 21ft 3in high, uses the "Tyrad" rewirable system which has a heating load of 200·25 kW to maintain an internal temperature of 50 deg F against an outside temperature of 30 deg F. 4·5 kW of floor heating is also installed in the offices, supplemented by a 1½ kW "Tyrad" storage heater, the canteen being heated by a 7½ kW "Tyrad" cabinet fan convector. The whole of the installation was carried out by the London Electricity Board contracting section.

Electric floor heating has been installed in the heavy plant store of the London Electricity Board at Brimsdown, Middlesex

House Magazine Award

The house magazine of the Automatic Telephone & Electric Co., Ltd., *Tone*, was voted the best house journal of the year when the results of the National House Journals Competition for 1958 were announced at the annual convention of the British Association of Industrial Editors held from 7th to 10th May at Llandudno. Mr. J. Wales, the editor, received the industrial editors' trophy (presented by the Monotype Corporation) from Lord Crook, president of the Association.

Welsh Technical Committee

The New Wales Union has decided to appoint a technical committee composed of Welsh engineers and members of the staff of the University of Wales to advise it on technical matters. The Union gave evidence before the Herbert Committee in which it urged that Wales should be treated as a unit for the generation and distribution of electricity.

Black & Decker European Development

Black & Decker, Ltd., announce the establishment of a new organisation to expand their electric tool sales and service in the European Common Market. The existing companies in Holland, Belgium and Germany will be key points in the new plan with Black & Decker (Belgium) S.A., Brussels, as the administrative and warehousing centre. Mr. M. F. J. Wright has been appointed sales director of the Belgian company; he was responsible for establishing the company in Brussels two years ago.

Electrical Engineers' Exhibition

An exhibitors' meeting in connection with the 1959 Electrical Engineers' Exhibition will be held on Tuesday, 3rd June, at 3 p.m. at Caxton Hall, Westminster, S.W.1.

Pumping Plant for Canadian Power Station

The boiler feed pumps for the Hydro-Electric Power Commission of Ontario's Lakeview generating station, Toronto, Canada, have been ordered from the Harland Engineering Co., Ltd. Each of the six feed pumps will be driven by a 5,000 h.p. motor through a fluid coupling and will be serving the first of two 300 MW turbines in this power station.

Commercial Travellers' Benevolent Institution

The half-yearly Court of Governors of the Commercial Travellers' Benevolent Institution will be held at the Berners Hotel, Berners Street, London, W.1, at noon on 21st June.

Underground Machinery Exhibition

The Council of Underground Machinery Manufacturers is to stage a comprehensive exhibition of its industry's products at Olympia from 9th to 18th July next year. In addition to the displays by members of the Council and other manufacturers, a three-day symposium on shaft sinking and tunnelling, arranged by the Institution of Mining Engineers, will be held in connection with the exhibition.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £179 5s 0d
Fire Refined 99·70%	ton £178 0s 0d
Fire Refined 99·50%	ton £177 0s 0d
COPPER Tubes ..	lb 2s 8¾d
Sheet	ton £205 10s 0d
H.C. wire and strip ..	ton £227 5s 0d
LEAD, English ..	ton £71 10s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £76 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £61 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 5¾d
Sheet	ton —
Wire	lb 2s 3¾d
PHOSPHOR BRONZE Wire	lb 3s 6¾d
PLATINUM	oz £25 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 22¼d—22½d

New Ship-Shore Service from North Foreland

Work has started on providing a new v.h.f. ship-shore service which will be opened about the end of August next. This service will provide radio-telephone communication between ships in the sea areas around North Foreland and any telephone subscriber in the United Kingdom. The shore equipment will be installed at, and calls handled by, the existing Post Office coast radio station at North Foreland. It is expected that the radius of the service area will be about 40 miles over a continuous sea path. The equipment at the coast station and on ships will comply with internationally recommended technical characteristics and will use frequency modulation. A specification has been agreed in the United Kingdom for ship station equipment in accordance

with these characteristics. Two separate channels will be provided at the coast station—a single-frequency calling channel on 156·8 Mc/s, and a two-frequency traffic channel using 161·9 Mc/s for transmission and 157·3 Mc/s for reception.

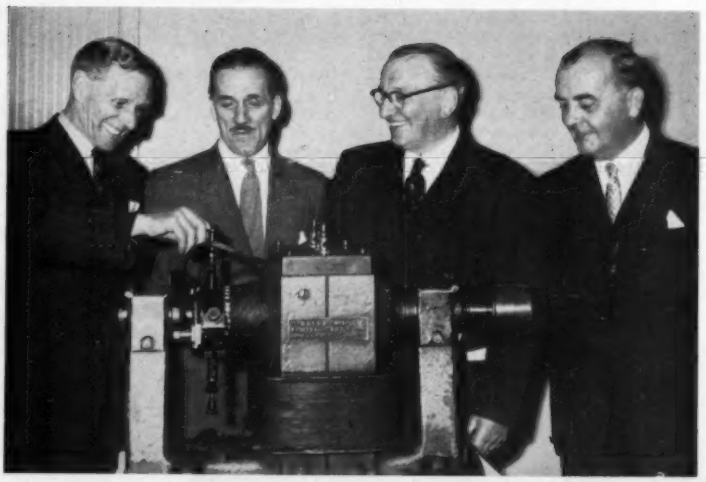
Further v.h.f. services are being planned from the existing coast radio station at Niton (Isle of Wight), Humber (Mablethorpe) and Lands End. It is hoped that these services will all be in operation by the middle of 1959, but the service at Niton may open early in the year.

Equipment for Venezuela

Orders for electrical equipment amounting to £1,600,000 have been placed with six British firms in connection with a project being carried out by Compania Shell de Venezuela for the disposal of the crude oil produced from the oilfields around and in Lake Maracaibo in Western Venezuela.

A terminal called Puerto Miranda is being built by C.S.V. at Punta Gorda inside the entrance of the lake, for the collection, storage and shipment of this oil. Some 170 km of trunk pipelines will feed the terminal from oilfield dispatch points at Bachaquero, Lagunillas and Cabimas on the eastern shore of the lake. An order worth over £500,000 has been placed with the South Wales Switchgear Co., Ltd., for the switchgear and control gear for valves, etc., associated with the electrically driven pumps, varying from 500 h.p. to 2,500 h.p., needed to drive the crude oil through the pipelines. Both pumps and motors are being manufactured in Holland.

The necessary electric power for the project, excluding the terminal proper, will be made available from Compania Shell de Venezuela's power station at Las Morochas, which is being extended by three 20 MW gas turbo-generators costing nearly £2 million, one American-built and two from Switzerland. The h.v. switchgear and main control boards for the new power plant extension will be supplied by A. Reyrolle & Co., Ltd. Distribution of the extra power that will be generated is a major project in itself, for which all the equipment has been ordered in the United Kingdom. Main distribution will be by means of new twin single circuit 115 kV and existing 69 kV overhead transmission lines, the former being supplied by British Insulated Callender's Construction Co., Ltd., at a cost of over £200,000 for the material alone. There will be two step-up and two step-down switching substations for 115/34·5 kV, part designed and supplied by the English Electric Co., Ltd., costing £150,000, part by A. Reyrolle & Co., whose orders in connection with the power station extension and step-up substation amount to some £200,000. The 115 kV substations will each contain two main transformers rated at 40 MVA ratio 115/34·5 kV and fitted with on-load tap changing gear. These have been ordered from the British Thomson-Houston Co., Ltd., at a cost of £300,000.



Examining the brushgear of the veteran Crompton motor are, left to right, Mr. E. C. Ransley, director of the printing firm where the motor was employed, Mr. J. T. Webster (chairman, Museum Committee), Mr. W. S. Lewis (chairman, Midlands Electricity Board) and Mr. T. A. Littlewood (Crompton Parkinson, Ltd.)

Local distribution from the 115 kV grid will be by means of the existing network of overhead lines, reinforced where necessary with additional 34·5 kV switching stations. These are on order with the South Wales Switchgear Co. and A. Reyrolle & Co., utilising transformers on order with C. A. Parsons & Co., the English Electric Co. and Crompton Parkinson, Ltd. The total cost involved here is a further £250,000. The programme envisages some parts of the scheme coming into operation before the end of 1958 and erection on site of all this plant will be the subject of local contracts in Venezuela.

Veteran Motor for Museum

On 21st May, Mr. W. S. Lewis, chairman of the Midlands Electricity Board, presented the Birmingham Museum of Science and Industry with a d.c. motor built in 1900 at the Chelmsford works of Crompton & Co. (now Crompton Parkinson, Ltd.). Until recently, the 2 h.p. 1,200 r.p.m. motor was used for the line shaft drives of printing presses and according to Mr. Ransley, a director of the printing firm, the motor had given sixty years' trouble-free service. The motor was still working when M.E.B. engineers, in the course of their d.c./a.c. change-over scheme in Birmingham city centre, were obliged to remove it.

Mr. Lewis, in making the presentation said that he was glad to take part in the ceremony because it was a reminder of a little-known job that M.E.B. engineers had been working on for the last ten years—changing over consumers from d.c. to a.c. When the M.E.B. was established in 1948 there were about 940,000 consumers and 74,000 of them were on d.c. Today there were more than 1,400,000 consumers and there were only about 2,000 on d.c. all in the three towns, Leek, Dudley and Birmingham.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 16th May is deemed to be 186s 6d.

The "costs of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 16th May is 176·0 (1949=100) and 113·5 (1954=100); both figures are provisional. For turbo-generating and allied plant: Materials used in mechanical engineering industries 184·6 (1949=100) and 122·8 (1954=100), blast furnaces and iron and steel melting and rolling (40 and 41) 190·1 (1949=100) and 129·6 (1954=100); figures are provisional. The price of $\frac{3}{4}$in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 16th May) is 41$\frac{3}{4}$d per lb.

Electric Trains for Manchester-Bury Line

The British Transport Commission has placed an order with the English Electric Co., Ltd., Bradford, for twenty-six four-motor electrical equipments for new two-car multiple-unit trains to be built at British Railways' Wolverton Works for the Manchester-Bury electrified line of the London Midland Region. The first of the new multiple-unit trains will be introduced early next year, in replacement of the present trains, now over forty years old. The electrical equipments ordered will be constructed to operate on the 1,200 V d.c. third-rail system already

in use on the Manchester-Bury line. This system (the only one of its kind in the country) is to be retained on this particular line because conversion to the overhead system of electrification, involving considerable engineering work, would defer for some years the provision of new rolling stock for the Manchester-Bury service.

Window Dressing Competition

Morphy-Richards, Ltd., have announced the results of their "Wedding Gift Parade" window dressing competition. Over 300 entries were submitted by stockists from all over the country. The first national prize of £500 has been awarded to R. W. Weekes, Ltd., Tunbridge Wells, the second prize (£250) to the Yorkshire Electricity Board's Service Centre, Leeds, and the third prize (£100) to H. W. Peak, Ltd., Cambridge. In addition there were six regional prizes of £50 each and 100 consolation prizes.

The winning display (R. W. Weekes, Ltd., Tunbridge Wells) in the Morphy-Richards competition

Engineering Company's Bicentenary

To mark their two-hundredth anniversary, Fawcett Preston & Co., Ltd., of Bromborough, Ches., have produced a handsome, well-illustrated volume surveying the company's history and achievements. As far back as 1817 "Fosset's" (as the company is locally known and which is used as the title for the book) was producing marine engines. It later entered other fields and is now one of the world's leading baling press manufacturers, apart from being a producer of hydraulic pumps, extruding machinery, electrical resistors, etc. In 1948 the company became a member of the Metal Industries group.

Scientific Film Congress

The 12th Congress of the International Scientific Film Association will be held this year in Moscow from 10th to 20th September. It will be attended by delegates and observers from more than thirty countries, and is being organised for the Council of I.S.F.A. by the Soviet Ministry of Culture and the Association of Film Makers of the U.S.S.R. The Scientific Film Association, 164, Shaftesbury Avenue, London, W.C.2, as the national body recognised by I.S.F.A., will both organise the British delegates and select the British film and photographic entry.

Film sponsors, producers and distributors should submit details of any British films they wish to be considered for selection to the S.F.A. Films will be considered for the following categories:—Documentary and educational films used to popularise science and technology; research films in any branch of science or technology; films concerned with any of the following technical aspects of scientific cinematography, for screening at special sessions: — Film problems in the field of astronautics; the use of television and brilliancy amplifiers in scientific cinematography; the influence of light on the structure of living cells filmed under the microscope; and a comparison of the results obtained by examining living cells by phase-contrast and interference cine-microscopy.

An exhibition of scientific photographs will be organised during the Congress. Further details can be obtained from the S.F.A.

Annual Holidays

The works of the Northern Aluminium Co., Ltd., will be closed for the annual holidays as follows:—Banbury, from 25th July to 11th August; Rogerstone, from 1st to 18th August; and Handsworth, from 22nd August to 8th September.

The Luton works of the Jackson Electric Stove Co., Ltd., will be closed for the annual holiday from 18th July to 5th August. The administrative offices and stores at Luton will remain open to deal with urgent requirements. All branch offices and depots will also remain open as usual.

British Railways Delegation Visits Russia

A delegation from the British Transport Commission and British Railways, led by Sir John Benstead, deputy chairman of the Commission, left London on 20th May, for a three-weeks' tour of the Russian railways as guests of the Ministry of Railways, U.S.S.R. The visit follows a similar tour of British Railways made by a party of seven Soviet railway experts last November. The British party is visiting Soviet railway works and installations, particularly those where important developments have been carried out in recent years. Their itinerary will cover progress in electrification and diesel traction; gas turbine locomotive development; modern methods of permanent way construction; train operation; marshalling yard operation; the design of passenger coaches and wagons; and signalling, telecommunications and automatic train control.

Trade Announcements

The development and workshop production sections of the Engineer-in-Chief's Department of **Cable & Wireless, Ltd.**, at Radio House, near Liverpool Street Station, London, are to move to more commodious premises in Kirby Street, E.C.1. The new building has been named Smale House after Mr. J. A. Smale, former engineer-in-chief of Cable & Wireless, Ltd., who, until he retired in March last year, was closely associated with the research and development work of the company. Smale House has a total floor area of 23,690 sq ft.

BX Plastics, Ltd., announces that arrangements have been completed to manufacture and market a full range of the irradiated polythene tapes developed by the Tube Investments Research Laboratories at Hinxton Hall, near Cambridge. Special sizes and thicknesses of tape will be produced and, by arrangement, will be processed on T.I.'s high energy accelerator where research and development work on the application of the tape will continue.

The North West Regional office and depot of **Dexion, Ltd.**, is now at Sandy Lane, Lowton, near Warrington, Lancs. (telephone: Leigh 1568).

High Duty Alloys, Ltd., announces that as from 2nd June the address of its Scotland and Northern Ireland area sales office will be Atholl Avenue, Hillington, Glasgow, S.W.2 (telephone: Halfway 5274).

A new cable store has been opened by **W. T. Henley's Telegraph Works Co., Ltd.**, in Birmingham. The store adjoins Henley's Birmingham branch at 158-161, Great Charles Street.

Belling & Lee, Ltd., have appointed Mr. C. F. Greenwood as representative for Scotland and Northern Ireland.

Nettle Accessories, Ltd., has appointed Mr. B. Tolhurst as sales representative in South West England and South Wales.

In our last issue we reported the acquisition of premises at Stockport by Nettle Accessories, Ltd., for its sales division. The company now informs us that the telephone number should have read Stockport 7155.

Grid Communications*

Standardisation of Control Facilities

By P. F. GUNNING

BRITAIN'S 132 kV and 275 kV grid, comprising 390 transmission and 280 generating stations (24,000 MW at March, 1958) is mostly controlled by the power station control engineers to the instructions of area control engineers in the seven Grid Control Centres (G.C.C.s) in England and the one in Scotland. A National Control Centre in London, commissioned in 1938 to co-ordinate the operation of the G.C.C.s, ensures that the country's demands are met with adequate generation, secure transmission and overall economy. Since 1955 the grid in Scotland has been operated independently but in liaison with the National Control Centre.

In the early '30s the control areas had been separately equipped with different systems of general indicating, telephone and telemetering equipment. Operating over rented Post Office networks, these early systems served their purpose but could not provide facilities which operating experience over the years had shown to be necessary, nor without expensive extensions could they cater for expansion of the grid which has continued at a rate which shows no sign of diminishing.

With the change in ownership of the electricity supply industry in 1948, it was necessary to provide private line communications between power stations and the divisional headquarters in the 14 newly created Generating Divisions.

In 1949 the British Electricity Authority decided to re-equip the grid control networks, then 15 years old, and invited telephone manufacturers who had equipped the areas to co-operate with the Authority in the design of a "standardised system" as it came to be called. A Telecommunications Technical Committee was set up and the Authority specified the facilities to be provided by the new system. Because the G.C.C.s were congested, the Authority, with recollections of wartime experiences, built new centres in more suitable districts.

The T.T.C. found that the standardised system could not be a precise installation with universal application because of the complex variety of stations and network conditions in the various control areas. Instead, many items of basic equipment were standardised for installation in combinations to suit the requirements of different stations and G.C.C.s. When sufficient items had been codified and the planning parameters of the new system determined, the Authority was able to plan the new control networks and to issue the contract specifications. Because of the large re-equipment programme confronting the manufacturers the 14 Divisions provided and set to work at the stations the "associated equipment" specified by the T.T.C., such as telemeter initiating devices, indicating instruments and instructors on power station control desks, power supplies and connections to grid switchgear and station P.A.X.s. Over the last 25 years no better alternative has been found to the use of rented Post Office circuits for the grid control networks.

In the standardised system, the stations in a control area are considered as being major stations or minor stations (Fig. 1). Major stations send signals to and receive signals from a G.C.C. Minor stations send signals to and receive signals from major stations. A major station usually has a direct line to the G.C.C., in which case it is termed a radial station and has a direct line to each associated minor station, usually not more than three or four. A major station is usually a generating station or a large attended grid station. A minor station is usually a small grid station or bulk supply point to an Area Board.

To economise in rented lines, the more distant major

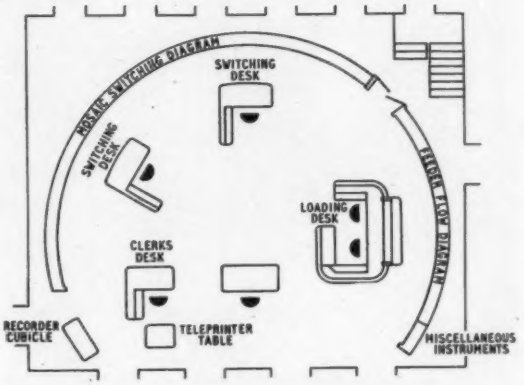


Fig. 2.—Thames North control room

* Author's summary of a paper entitled "Standardisation of Control Facilities for the British Grid Communications, Indications and Telemetering" which was presented to the Supply Section of the Institution of Electrical Engineers in London on 28th May.

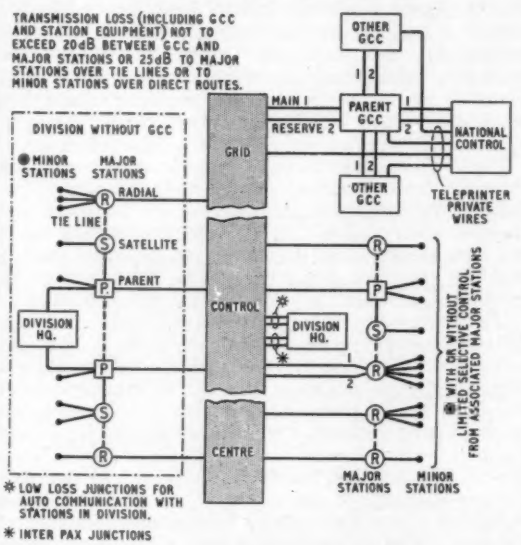


Fig. 1.—Typical communication network for a grid control area

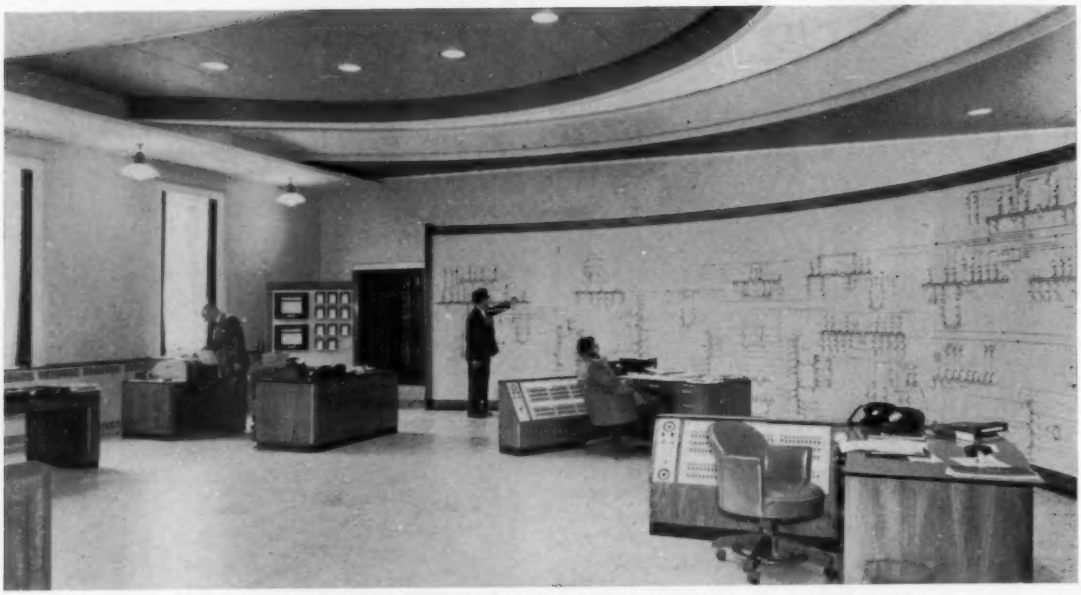


Fig. 3.—Thames North control room showing clerk's desk, recorders, mosaic switching diagram and switching desks

stations are connected in groups usually of two but to a maximum of four stations. A group is served by a line from the G.C.C. to the nearest or most important station in the group and from this parent station by separate lines to each of the satellite major stations in the group. Pairs of major stations with separate routes to the G.C.C. are interconnected by tie lines to provide an alternative though indirect means of communication with the G.C.C.

The larger 275 kV major stations in each control area usually have reserve lines which are switched to take over service should the normal lines fail. Tie lines and reserve lines are routed at the Board's request to avoid cables containing normal control lines. A new National Control network is being provided for general indications, telephones and telemetering. This network will also give direct communication facilities between G.C.C.s and connect with standby National Control Centres. The G.P.O. teleprinter network between National Control and the G.C.C.s which has been in service since 1938 will reinforce the new network.

Fig. 4.—Thames North control room showing switching diagram, loading desk and feeder flow diagram

In each of the G.C.C. control rooms the layout of the control equipment is different. The arrangement of the mosaic switching and feeder flow diagrams, control desks and miscellaneous equipment in the Thames North control room is shown in Figs. 2, 3 and 4.

Mosaic switching diagrams have proved since 1936, when they were first introduced, to be the only practicable means of keeping pace with the expansion of the grid. They comprise many thousands of small interchangeable plastic squares engraved to represent different items of transmission and switchgear equipment. Semaphore symbols representing circuit-breakers flash, until corrected by the switching control engineer, should they be in discrepancy with the automatic signals from the stations.

Feeder flow diagrams were introduced in 1937. On these diagrams telemeters positioned in the mimic lines indicate the magnitude and direction of the active and reactive power flow in the grid feeders. In each line a red lamp flashes when the current in the corresponding grid line exceeds a preset value and green lamps at the line ends light when the grid switchgear opens the line.

The control desks are equipped with keyboards for calling or answering any control telephone in the area with complete priority over administration traffic originating from offices at the G.C.C., the associated divisional headquarters, or from the P.A.X. telephones in the power stations. On the loading desk 11in strip chart recorders indicate area net transfer, area total generation and system frequency, and there is an indicator for rate-of-change of system frequency and a telemetered indication of daylight intensity from a selected station in the area. Also on the loading desk are visual telegraph (16 message) and MW output generation instructors for

the individual power stations in the area. During mains failure diesel driven alternators serve the G.C.C., and the system frequency instruments are automatically switched to an amplified signal from a grid station.

The " standardised system " enables unattended minor stations to be remotely controlled from the associated major stations, usually by power station control engineers. As a precaution against rented line failure this method of control is reinforced at the minor stations by automatic reclosure of the grid circuit-breakers.

Different systems of intertripping have been in widespread use on the grid control networks since the early '30s. In recent years the earlier systems have been outmoded with the introduction of 132 kV fault throwers and direct point-to-point high speed intertripping systems. A recent addition to the standardised system provides for the transmission of signals, initiated by high speed line protection, to accelerate the operation of remote distance protection equipment or to unlock inhibited directional overcurrent tripping relays at remote transformer feeder stations.

As a possible future requirement, automatic frequency control is being developed for integration with the standardised system.

By G. A. BURNS, F. FLETCHER, M.B.E.,
C. H. CHAMBERS and P. F. GUNNING

Grid Indication and Telemetering Equipment*

MOST rented lines in the grid control areas are short enough to permit earth return d.c. phantom signalling, a method of signalling which does not interfere with speech or v.f. telemetering (Fig. 1). At stations where isolation is not required the earthed 50 V station batteries are used for line signalling. Impulses are transmitted at 10 a second with 50 millisec make periods and marked impulses are signalled by increasing the make period to 160 millisec.

On lines where d.c. signalling cannot be used the well-established practice of using 300 c/s tone signalling has been retained; the speech band is restricted at the lower end to 400 c/s and 480 c/s is used for the ringing and busy tones. The 300 c/s signalling is used to minimise impulse distortion of signals relayed by parent stations and to free the d.c. channels to satellite stations for inter-station telephone dialling. The speech band is also restricted at the upper end to 2,000 c/s to permit the simultaneous transmission of speech and of telemetering at 2,220 and 2,340 c/s.

From the G.C.C.s the d.c. or 300 c/s channel is used to select visual telegraph and total generation instructions and to make telephone calls. From the stations these same channels are used for telephone calling and clearing and to indicate circuit-breaker operation, directions of telemetered feeder flows and acknowledgment of telegraph and generation instructions. To prevent lockout by heavy traffic, the common channel is used in turn by the selection, indication and telephone trains. Selection trains employ binary coding with each variable comprising two complementary pulses—long and short or short and long. To select any one of six instructors the selection train is prefixed by a four-pulse code containing two marked impulses. Proof of selection is based on total count and that each vari-

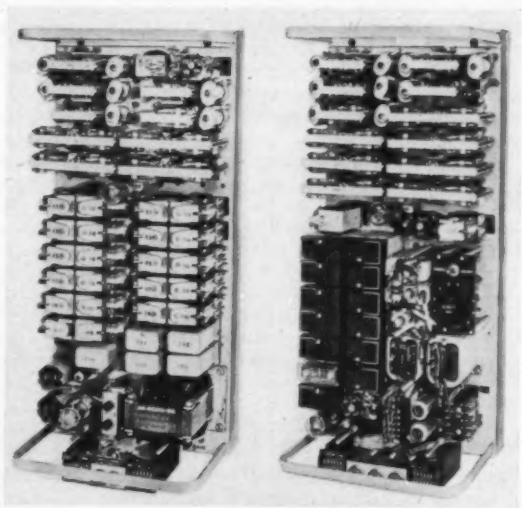


Fig. 2.—Ten-way coder/sender and decoder

* Authors' summary of a paper entitled " The Development of Communication, Indication and Telemetering Equipment for the British Grid," presented to the I.E.E. Supply Section on 28th May.

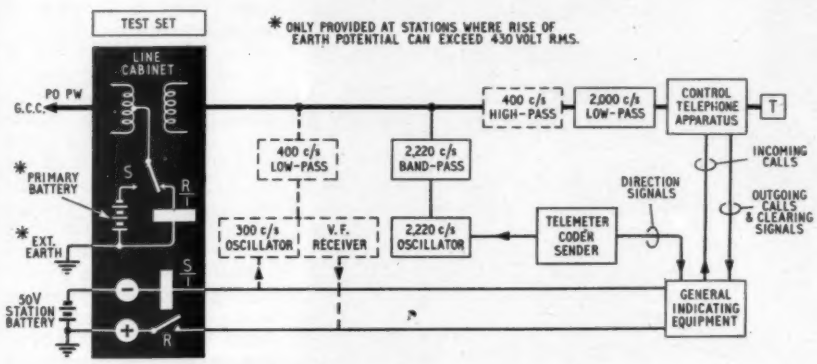


Fig. 1.—Telephony and line signalling at outstation

able of the binary code contains a long and short impulse.

At the G.C.C. the point indicating equipment for each P.O. line has a capacity of 240 in six groups of 40. The indicating trains, which are proved by total count, cater for the different groups of 40 points by means of a prefixed four pulse six group selection code and a marked pulse to direct the ensuing 40 pulses to the indication relays. If this pulse is unmarked the ensuing pulses are switched to the telephone calling equipment.

When an indication train is transmitted from a satellite station, it is relayed by the parent station which is prevented from sending as also are the other satellite stations. With an additional four-pulse group selection code, selection trains from the G.C.C. are relayed by the parent station into the local equipment or the particular satellite station as required.

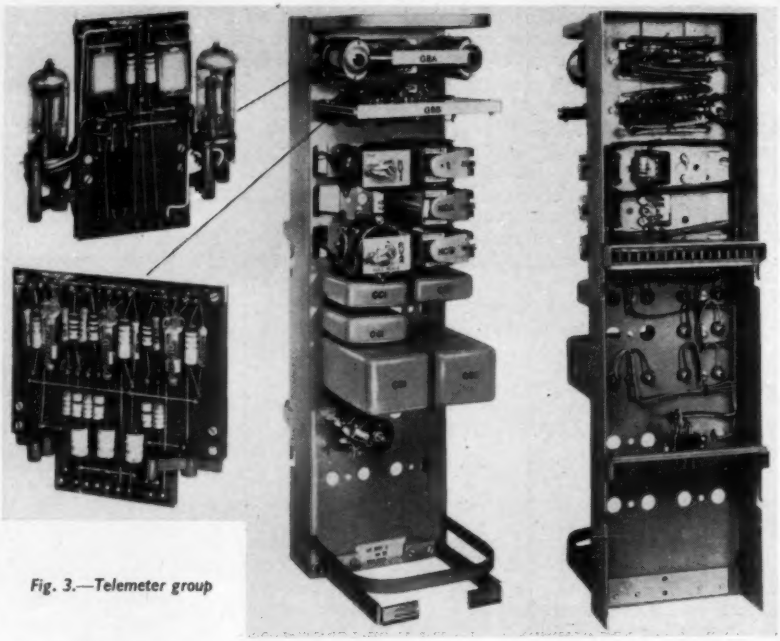


Fig. 3.—Telemeter group

The grid control telephones at the stations are called with the minimum of pulses. The calling channel is not held during conversations but talking proceeds with the called party holding himself to the line. This leaves the common channel free for subsequent priority calls, selections and indications, but it necessitates calls from the G.C.C. to be held until the called party answers or until a self-resetting delay circuit operates. At the conclusion of a call to the G.C.C. a simple code is sent from the stations to clear down connections extended into office P.A.X.s by telephone operators at the G.C.C. or divisional headquarters.

At major stations grid control extensions can dial each other and can set up calls independently of each other and also can make direct calls to stations linked by the network. On engaged calls the user receives the busy tone but on calls to the G.C.C. control engineers, priority can be exercised by dialling an extra digit. Priority calls disconnect non-priority parties who then receive the busy tone. Priority calls do not disconnect control engineers' conversations but the G.C.C. control engineer is made aware of the call by the calling lamp. The G.C.C. control engineers can call any control telephone, even though the telephone may already be engaged, and can throw off unwanted control telephones by subsequent telephone selection.

To ensure an always satisfactory speech level, the overall transmission loss is not permitted to exceed 20 dB from the G.C.C. to major stations, 25 dB to minor stations and 25 dB to major stations over tie lines.

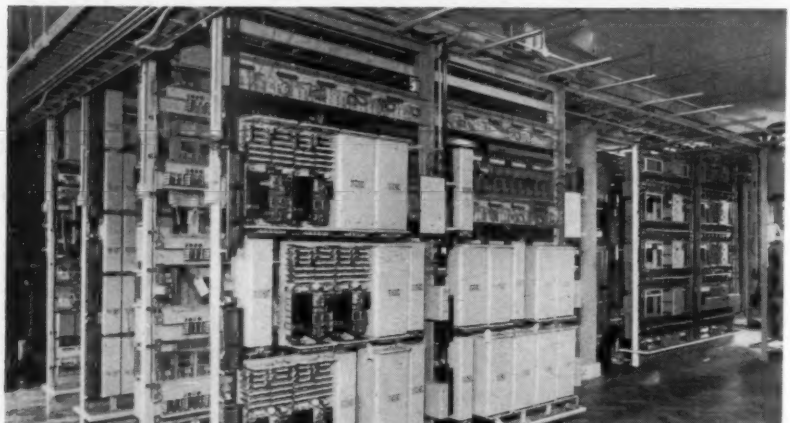


Fig. 4.—Apparatus room with decoder racks in foreground

Minor stations are arranged as extensions on major stations and use d.c. earth return phantom signalling for telephone calling and breaker indications. The minor station telephones dial into a control telephone connector at the major stations. The indication trains are decoded at the major station and retransmitted as if they were the major station's own indications. When required visual telegraph selections from the G.C.C. are decoded at the major station and retransmitted to the minor station as 300 c/s selection trains. With a small addition these 300 c/s selection trains can be set up by the station operators at the major stations to control grid switchgear at unattended minor stations and the switch-

gear indications from the minor stations can be displayed at the major stations as well as at the G.C.C.

In the early '40s single telemeters which required individual signalling channels were superseded by systems which catered for a number of telemeters on one channel. These multiplex systems served their purpose but it was evident that their reliance on telephone relays was unsuitable for continuous operation. An electronic multiplex telemetering system was in consequence adopted for the " standardised system " using a simple time division arrangement in which ten induction type impulse meters are scanned every 300 millisec by a ten-way coder/sender (Fig. 2). At the G.C.C. the decoded impulses operate electronic telemeters (Fig. 3) to produce d.c. voltages in direct proportion to the impulse rates. Indications of the direction of telemetered power flow are transmitted by the general indicating equipment as point indication so that the full capacity of the multiplex signalling system is available for magnitude telemetering. Fig. 4 shows an apparatus room in one of the new Grid Control Centres.

The standardised system is now in full operation in all control areas of the C.E.G.B., and the benefits of standardisation and of co-operation between manufacturers, the G.P.O. and the Generating Board are abundantly clear. Without this the re-equipment programme would have been impossible on both practical and economic grounds.

Although some time must elapse before the new national control network is completed, operational experience has been most gratifying in those areas where the standardised system has been in operation for some time.

Electrical Safety

ANALYSIS OF ELECTRICAL ACCIDENTS IN FACTORIES

THE publication of the Ministry of Labour and National Service entitled " Electrical Accidents and Their Causes " for 1956 is now available (H.M. Stationery Office, 4s 6d). It records that the number of such accidents reportable under the Factories Acts (i.e. entailing three days' disablement) was 797, of which 40 (23 up to 250 V) were fatal, compared with 739 and 42 in 1955. In addition, 43 known fatalities occurred in other industrial or similar premises and 61 in domestic or similar premises, bringing the aggregate of fatalities up to 144 (142 in 1955).

Of the 797 accidents, excluding eye-flash from welding (169 cases), 206 (19 fatal) were caused by portable apparatus and cables, mainly among unskilled people, and 233 (six fatal) were associated with transformers, switchgear and fuses, mainly among electricians. The number of electrical accidents involving shock, with or without burns, was 333, while the number of accidents involving burns, with or without shock, was 437 and the number of accidents involving shock and burns together was 156. These figures may correct the common misconception as to the nature of electrical accidents, the fact being that the total incidence of burns is greater than the total incidence of shock.

APPARATUS INVOLVED IN REPORTABLE ACCIDENTS

Apparatus	Fatal	Non-Fatal
Portable and Transportable Apparatus		
Portable electric machines, etc.	7	49
Portable heaters and irons	—	6
Portable lamps	5	14
Portable testing sets, including lamps, instruments, etc.	—	39
Plugs, sockets and adaptors	2	25
Cables and flex for portable apparatus	5	31
Electric hand welding:		
Shock and/or burns	—	23
Eye injuries	—	169
Fixed Apparatus		
Electrical machines	—	10
Transformers and reactors	—	9
Switchgear above 650 V:		
Switchboards	5	43
Motor or other control apparatus	—	3
Switchgear below 650 V:		
Switchboards	—	66
Motor or other control apparatus	—	56
Fusegear	1	50
Crane and other trolley wires, etc.	4	17
Fixed lamps	1	16
Cables and accessories for fixed apparatus	1	72
Test leads, test terminals, etc.	1	18
Overhead transmission and distribution lines:		
Contact by cranes or similar machines	5	2
Direct contact by persons or materials and tools	1	6
Apparatus not classified	2	33
TOTAL	40	757

Five of the fatal electrical accidents reported during the year were the result of falls following electric shock (two men had fractured skulls), four men died of burns and one was killed by an explosion. Of the remainder, 23 received artificial respiration for periods between 10 minutes and 3 hours but in seven cases there was a delay in starting; in two cases the delay was 20 minutes and in one case half an hour. The report says there is no doubt whatever that a man who receives prompt artificial respiration has an immeasurably greater chance of recovery than one who does not and this emphasises the need for practice in first aid measures so that proper assistance can be given until a doctor can be brought to the scene.

Electronic Control of Machine Tools

AT the conference of the Institution of Production Engineers held in London from 12th to 21st May, Dr. Koenigsberger (Manchester College of Technology) gave a paper on the design of automatic machine tools for electronic control, many examples of which were given. The aim was to enable electronic devices, following the collection of information and its conversion into suitable form by the human brain, to perform all the tasks that would otherwise require a manual operator. Electronic functions would include the checking and measuring of movements and the correction of any errors (by servo-mechanisms) before proceeding to further stages. Working speeds were not limited by inertia of moving parts as in manual or automatic cam control and more operations could be carried out simultaneously, resulting in a much higher rate of metal removal. Operational forces and speed governed the power requirements, which must be closely determined to avoid waste of energy.

OVERSEAS ELECTRICAL TRADE

Exports of Heavy Electrical Plant Maintained

ALTHOUGH the total value of British electrical exports in April, at £18,804,199, showed a decline of over £1,000,000 as compared with the preceding month, it was nevertheless about £1,300,000 higher than the total for the corresponding month of 1957, and the total of £77·1 million for the first four months of this year is about £3 million better than for the corresponding period of 1957. The incidence of the Easter holidays, of course, accounts for some of the decline as compared with March, but the continued fall in cable exports (from £2,516,095 in March to £1,914,905 last month) was also an important factor. There appears, however, to be no slackening in the demand for heavy electrical machinery, exports of generating sets, generators and motors in April reaching a total of £3,516,859, as compared with £3,476,016 in March and £2,509,072 in April last year. Shipments of converting machinery, mercury-arc rectifiers, transformers, switchgear, etc., remained steady at £2,546,152

TABLE I.—ELECTRICAL EXPORTS

Class	Month of April, 1958	Four months ended 30th April, 1957	Four months ended 30th April, 1958
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	165,678	602,869	562,949
Ditto, 10 to 65 kW	164,244	616,851	737,222
Ditto, 65 to 200 kW	127,508	384,048	764,468
Ditto, over 200 kW	272,078	1,007,189	1,321,491
Spark ignition engine driven	6,595	59,288	49,597
Steam turbine driven	27,548	230,292	319,705
Hydraulic turbine driven	—	—	—
Other prime mover driven	10,041	111,271	47,891
Generators, not exceeding 200 kW	86,136	630,136	588,165
Ditto, over 200 kW	109,348	293,394	379,621
Parts of generators	1,323,677	1,709,731	3,230,566
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	144,418	800,663	608,387
Over ½ but under 1 h.p.	55,649	195,885	239,443
1 h.p. to 250 h.p.	450,234	2,007,840	1,964,033
Over 250 h.p.	154,424	439,673	481,566
Railway, tramway and trolley-bus motors complete and parts of all motors	133,170	695,404	886,489
Motor starting and controlling gear	286,111	1,310,495	1,115,930
	3,516,859	11,095,029	13,297,523
Converting machinery	25,546	327,003	150,358
Mercury-arc rectifiers	146,586	204,301	412,131
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	609,346	2,515,806	2,709,783
Over 7,500 kVA	298,713	865,279	1,418,039
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	426,752	1,288,831	1,820,271
Ditto, other	1,039,209	4,518,032	4,064,424
	2,546,152	9,719,252	10,575,006
Primary batteries:			
Lighting	68,711	396,195	361,549
Radio	292,570	1,098,375	1,147,827
Other	57,310	178,711	193,857
Parts (excl. carbons)	42,707	209,082	186,837
Lamps:			
Filament, exceeding 28 V	78,185	347,402	358,284
Ditto, under 28 V	28,536	132,256	115,392
Arc lamps and searchlights	13,053	57,812	62,732
Discharge lamps, fluorescent tubes, etc.	75,317	403,947	352,506
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	16,622	103,935	115,257
All other	322,843	1,125,632	1,351,913
Parts (excluding glass bulbs)	21,335	43,543	66,221
Radio and television transmitters	73,833	271,884	217,396
Commercial radio and radar equipment	1,545,056	5,045,152	5,093,876
Domestic radio receivers, mains	88,829	487,629	356,164
Ditto, battery	56,629	234,371	210,505
Ditto, other (incl. car)	28,412	98,965	105,810
Radiograms	38,669	112,969	157,822
Television sets	120,994	240,909	520,163
Public address equipment	106,197	390,179	439,600
Other radio and television apparatus, n.e.s.	35,043	234,009	131,852
Components and parts, n.e.s.	711,680	3,102,854	3,091,881
	3,166,142	11,492,031	11,858,460
Telegraph and telephone installations	642,464	2,446,832	3,383,493
Telephone instruments, separately consigned	118,291	682,407	834,132
Telegraph and telephone parts	802,081	3,308,021	3,094,376
Line apparatus for long distance communication	211,777	362,620	782,018
	1,774,613	6,799,880	8,094,019

Class	Month of April, 1958	Four months ended 30th April, 1957	Four months ended 30th April, 1958
	£	£	£
Cookers	39,257	263,123	205,401
Toasters	17,164	73,773	92,697
Other cooking apparatus	37,127	127,193	151,937
Parts and accessories	58,979	291,007	241,026
Space heating appliances	32,922	149,304	178,777
Water heating appliances	29,298	126,143	112,738
Other heating appliances	25,190	176,622	174,140
Parts and accessories	59,913	251,202	236,035
Irons	73,057	262,203	329,431
Arc welding equipment, a.c.	97,057	240,467	352,281
Ditto, d.c.	91,056	179,644	175,181
Resistance welding equipment	11,792	98,150	57,658
Electric furnace plant	46,914	393,996	303,993
Magnetos, ignition	15,767	132,752	67,500
Sparking plugs	148,182	631,335	585,733
Elec. appliances for aeroplanes, n.e.s.	293,928	1,063,544	1,099,775
Ditto, for motor vehicles, n.e.s.	447,435	1,438,291	1,666,995
Ditto, for cycles, n.e.s.	61,806	233,168	226,423
Signalling app. (incl. traffic signals)	137,433	447,159	662,459
Instruments, commercial	172,243	761,482	709,139
House service meters (including parts)	126,332	663,770	650,603
Electro-medical apparatus (not X-ray)	66,939	127,149	176,218
X-ray apparatus (excl. tubes and valves)	47,867	253,891	239,484
Vacuum tubes	47,631	170,480	187,931
Ceiling fans, complete	67,775	460,069	421,827
Desk fans, complete and parts of desk and ceiling fans	25,388	147,399	106,377
Vacuum cleaners	147,313	595,767	589,004
Floor polishers	68,938	346,294	278,742
Food mixers	54,293	196,426	220,522
Hair clippers and dry shavers	38,055	328,466	201,473
Other portable appliances	12,483	117,383	81,823
Parts	81,227	512,209	464,198
Portable elec. tools (not saws) and parts	201,929	881,127	916,157
Cables and wires:			
Telegraph and telephone, submarine	46,662	184,284	245,240
Ditto, other	346,813	3,876,261	2,319,856
Cotton, silk or art. silk insulated	36,766	154,191	185,033
Enamel, glass or asbestos insulated	64,285	404,759	294,148
Paper insulated	640,788	3,432,648	2,546,169
Rubber insulated	423,039	2,218,567	2,058,133
Thermoplastic insulated	173,290	649,474	834,745
Other	183,262	806,709	978,538
	1,914,905	11,726,893	9,461,862
Accumulators for motor vehicles	173,936	585,276	622,549
Ditto, traction	16,244	122,778	93,026
Ditto, radio and other portable	50,781	344,631	212,487
Ditto, other	22,060	130,909	110,935
Parts and accessories	115,063	345,362	456,794
Electric wiring accessories	185,410	181,120	570,415
Elec. porcelain, etc. (incl. insulators), n.e.s.	103,191	449,848	402,519
Insulating cloth and tape	39,874	251,726	199,080
Other insulating material	82,142	372,807	374,515
Permanent magnets	52,080	182,430	210,760
Radio, telegraph and telephone testing equipment, n.e.s.	46,429	254,363	256,294
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	42,065	50,049	128,728
Other	346,202	1,168,302	1,360,725
Electrical machinery, n.e.s.	77,465	275,823	298,611
Electrical apparatus and appliances, n.e.s.	993,507	3,508,042	3,600,666
TOTAL	18,804,199	74,021,319	77,127,636

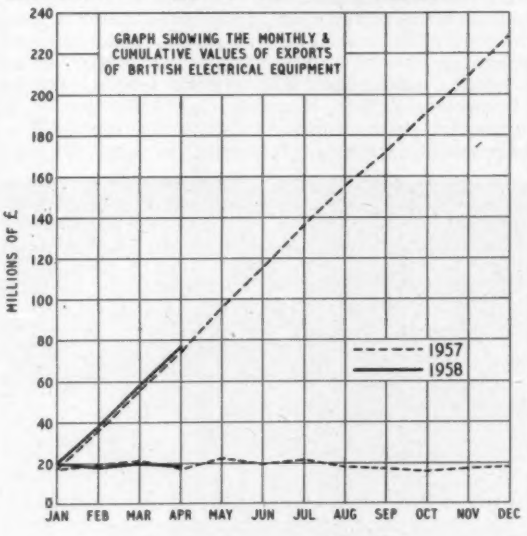
TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	Month of April, 1958	Four months ended 30th April, 1957	Four months ended 30th April, 1958	Country	Month of April, 1958	Four months ended 30th April, 1957	Four months ended 30th April, 1958
	£	£	£		£	£	£
Channel Islands	87,273	376,254	385,004	Netherlands	599,934	2,773,950	2,441,363
Gibraltar	9,189	48,645	124,012	Belgium	378,554	1,300,776	1,299,247
Malta and Gozo	99,594	243,598	285,139	France	290,768	1,491,677	1,655,074
Cyprus	101,807	502,631	390,023	Switzerland	181,285	456,956	600,706
Sierra Leone	56,218	124,617	231,708	Portugal	263,753	1,052,528	1,522,973
Ghana	120,625	672,227	623,750	Spain	71,996	1,654,632	626,341
Nigeria	361,672	1,104,387	1,423,331	Italy	313,943	1,227,970	1,167,966
Union of South Africa	1,699,397	5,879,522	7,177,955	Austria	67,236	125,954	203,410
Rhodesia and Nyasaland	382,635	2,021,197	1,848,417	Yugoslavia	54,001	230,925	204,016
Tanganyika	50,409	229,312	201,844	Greece	61,229	624,757	369,202
Kenya	138,941	1,010,045	581,580	Turkey	171,274	206,116	506,403
Uganda	41,894	454,172	267,020	Belgian Congo	33,564	188,051	150,661
Mauritius	62,550	143,136	161,963	Portuguese East Africa	23,129	112,880	97,147
Aden	72,044	216,684	245,975	Egypt	60,568	853	375,259
Bahrain, Qatar and Trucial States	97,486	557,462	391,775	Libya	79,266	149,583	236,547
Kuwait	144,230	977,311	695,069	Southern Morocco	40,941	170,254	116,695
India	1,414,801	8,318,953	6,350,820	Sudan	95,185	330,806	341,904
Pakistan	167,872	1,208,597	1,014,387	Syria	27,970	138,831	94,016
Singapore	325,519	1,403,988	1,307,593	Lebanon	47,837	134,904	234,264
Federation of Malaya	234,077	1,211,003	1,154,257	Israel	197,095	250,853	423,390
Ceylon	153,726	577,320	529,471	Jordan	32,107	295,740	314,215
British North Borneo	29,047	87,846	96,442	Saudi Arabia	55,844	164,683	320,986
Sarawak	27,192	60,405	84,385	Iraq	154,604	989,242	1,062,306
Hong Kong	331,118	919,308	1,246,107	Iran	435,136	1,253,257	1,395,500
Australia	1,913,911	6,469,162	7,112,316	Burma	55,640	287,031	294,565
New Zealand	767,408	3,682,844	4,771,209	Thailand	160,943	368,587	681,285
Fiji	16,479	80,954	108,078	Indonesia	11,969	201,225	161,468
Canada	1,655,650	4,233,233	4,419,873	Japan	50,311	309,481	189,431
Jamaica	151,312	341,714	559,576	United States of America	484,206	2,932,645	2,329,157
Barbados	22,886	78,285	114,602	Cuba	36,486	161,337	357,880
Trinidad	109,444	487,521	470,990	Mexico	56,998	212,566	215,774
British Guiana	94,442	168,898	219,281	Colombia	23,675	178,247	187,119
Other Commonwealth countries	184,547	442,261	736,702	Venezuela	419,270	1,185,608	1,598,200
Irish Republic	286,505	879,877	1,145,641	Peru	28,907	272,753	146,495
Soviet Union	30,942	607,934	160,702	Chile	45,754	191,503	142,410
Finland	117,168	380,837	543,837	Brazil	125,178	318,326	451,499
Sweden	537,533	1,410,771	1,917,984	Uruguay	383	87,504	12,256
Norway	219,982	822,787	908,672	Argentine Republic	311,419	370,851	1,146,122
Denmark	164,000	849,395	738,639	Other foreign countries	326,927	1,372,700	1,322,951
Poland	39,414	133,841	297,275				
Western Germany	407,975	825,843	1,088,029	TOTAL	18,804,199	74,021,319	77,127,636

(against £2,670,661 in March and £2,443,825 in April, 1957).

There was some improvement in the radio and associated equipment group, exports rising from £2,973,405 in March to £3,166,142 last month; in April last year the total was £2,770,689. The month's total for telegraph and telephone material of £1,774,613 was nearly £250,000 lower than for March, but about £350,000 better than the April, 1957, figure.

Canada took first place as the leading purchaser of generating sets, generators, etc., taking plant in April valued at £835,947, India being second with £260,419 and Australia third with £238,990. In the converting machinery group the leading markets were South Africa (£471,741), India (£360,788) and Canada (£273,619).



The best market for radio and associated equipment was Australia with a total of £399,438, followed by Sweden (£233,852), the Netherlands (£201,840) and Western Germany (£200,651). Australia maintained her position as the leading market for telegraph and telephone apparatus with purchases of £390,512, and South Africa, with a total of £180,700 again held second place. In the cables and wires class, although India continued as the principal market her purchases of £374,967 were nearly £150,000 below the March figure. New Zealand held second place with shipments of £171,119. Table I details the exports of the various classes of goods and their destinations are shown in Table II.

Other electrical goods shown in the Board of Trade returns, but not included in the electrical section, include the following:—

Electric locomotives: April, £358,223; four months (January-April), £1,042,551 (against £1,475,720).

Electrically-operated washing machines, complete, not exceeding 150 lb net weight: April, £373,016; four months, £1,450,542 (£1,264,097). Ditto, 150-250 lb: April, £87,033; four months, £319,228 (£425,932). Parts: April, £74,696; four months, £262,783 (£226,843).

Welding electrodes: April, £128,103; four months, £506,213 (£481,914).

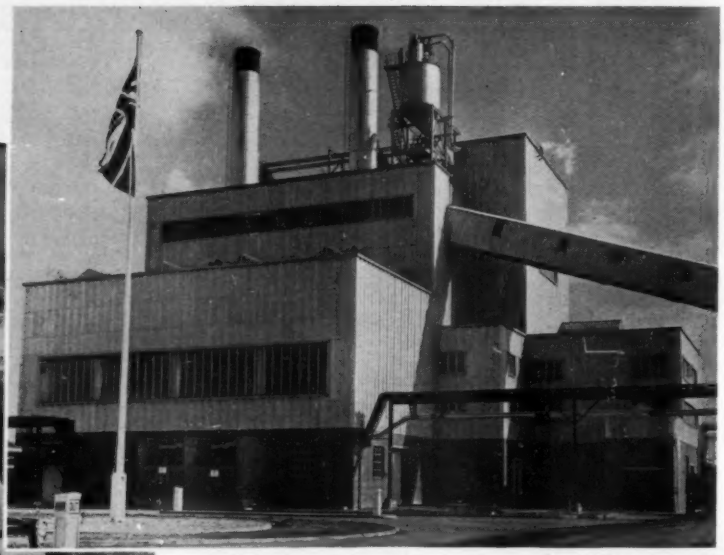
Electric conduit tubes and cased tubes: April, £50,929; four months, £235,389 (£356,324).

Electric carbons (including parts): April, £44,542; four months, £200,379 (£218,590).

Electric lighting fittings and lanterns (excluding arc lamps, searchlights, and lamps for road vehicles): April, £308,417; four months, £1,119,787 (£824,630).

Other electric lighting appliances (excluding vacuum tubes and lamp bulbs) and fittings and parts, n.e.s.: April, £59,243; four months, £364,894 (£1,002,255).

Electrical imports in April amounted to £2,338,672, as compared with £2,341,837 in March and £2,382,905 for April, 1957. The total for the first four months of this year was £9,240,515 (against £8,476,531 for January-April, 1957).



North Board Mill; the power station is seen at the lower end of the site

POWER FOR BOARD MILL

Electricity and Process Steam

AN entirely self-contained paper board mill with its own power station, extensive workshops, raw materials building, finishing department and water treatment plant in addition to the main production installations, was recently brought into production by the Reed Paper Group. The new North Board Mill of Colthrop Board & Paper Mills, Ltd., Thatcham, Berks, was built at a total cost of £5 million which included about £1·5 million for the power station.

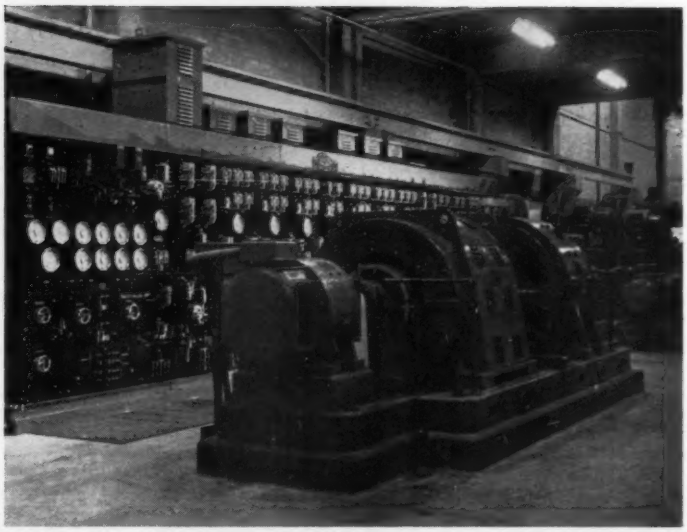
The board machine itself has an overall length of 325ft and at peak capacity it will produce a continuous length of board, 110in wide, at approximately 160 miles every 24 hours. Four main types of board are produced: white-lined manila, white-lined chip, cream-lined chip and kraft-lined chip. The board is sent to all parts of the country for conversion into folding cartons of every shape and size, for example, cigarette packets.

Power Station

In the power station two International Combustion boilers supply 88,500 lb/hr at 525 p.s.i. and 780 deg F at the superheater outlet for generation and process steam. The boilers are of the three-drum vertical tube type with an integral steam receiver between the boiler drum and the superheater inlet and have water-cooled front and side walls. They are designed to burn bituminous coal or coke-breeze and incorporate a chain-grate stoker. One oil burner is fitted at each side of the boiler for lighting-up purposes and each boiler is equipped with separate forced draught, secondary air and induced draught fans.

The boilers supply steam to two turbo-alternator sets, the main machine being of the pass-out condensing type generating at 11 kV, three-phase, 50 c/s and rated at 7·5 MW, 3,000 r.p.m. This set was supplied by the Metropolitan-Vickers Electrical Co., Ltd., and it is designed to pass out up to 120,000 lb of steam per hour to process at a normal pressure of 30 p.s.i. With no

Wet end of the paper board machine, looking towards the pre-dryers



Main motor generator set and switchboard for all wet-end and dryer section drive units of the board mill

steam being taken from the pass-out branch of the turbine an output of 3·5 MW is obtained from the set when operating as a fully condensing machine with 3,000 gal/min of circulating water. The turbine is of the single-cylinder impulse type with one velocity stage and seventeen impulse stages from inlet to pass-out and with one velocity stage and four impulse stages from pass-out to condenser. The turbine is fitted with oil relay governor gear. The alternator is of the totally-enclosed forced-ventilating type with a water-cooled air cooler. The exciter is direct coupled to the alternator. The second machine is an 8,500 r.p.m. back-pressure type generating at 415 V, three-phase, 50 c/s and rated at 500 kW with a maximum steam flow of 27,000 lb/hr exhausting to process at 170 p.s.i.

Piles were used for the foundations of the main mill buildings and the power station. For the power station, 265 piles were cast *in situ* by the Piling & Construction Co., Ltd. The main stanchions and beams are of reinforced concrete construction and the external cladding is in brickwork for the first 15ft above ground level and in asbestos cement sheeting with strips of continuous patent glazing from the brickwork to the roof level. The roofs of the turbine room and water treatment annexe are of barrel vaulted concrete construction and the main turbine block is independently constructed on a separate pile foundation.

Fuel Handling

The fuel handling plant includes a Strachan & Henshaw "Rotaside" wagon tippler for handling railway trucks of 10 to 25 tons capacity and discharging into an underground receiving hopper. The open side of this hopper is ramped for the discharge of end-tipping road vehicles. The discharge from the hopper is into a 24in wide belt conveyor and a Westminster type belt weigher is installed. The second inclined conveyor carries the fuel to the bunker where a travelling belt tripper is arranged to oscillate over the length of each bunker. The two suspended reinforced concrete fuel bunkers are constructed on three pairs of columns. Each bunker has a capacity of 250 tons of fuel.

All water requirements are pumped across the railway from the canal to a mill tank supplying both mill and power station and any excess water is returned to the canal.

Distribution

Power is supplied to the mill via an 11 kV ring main and a separate 11 kV ring main feeds the circulating water pump house. A standby supply at 11 kV from the Southern Electricity Board necessitates switchgear of 250 MVA rupturing capacity. This switchgear has been supplied by British Thomson-Houston and is of the solenoid-operated air-insulated vertical-isolation single-busbar type.

There are two substations in the mill situated as near as possible to the load centres, and at each of these there are two 2,000 kVA transformers interconnecting the 11 kV and 415 V switchboards. The main 415 V "AJ" circuit-breakers are of British Thomson-Houston manufacture and these supply the various multi-motor contactor switchboards supplied by the Igranic Electric Co., Ltd.

Board Manufacture

After preparation, the raw materials are deposited on a felt belt at the wet end of the board machine and pass through primary and main press sections followed by the drying sections. The machine is driven by a Harland interlocked sectional electric drive having an operating speed of 100 to 600ft/min with a crawl speed of 30ft/min. The 25 separate driving units are housed in an annexe and the driving shafts are connected to the machine through the wall. A 775 h.p. synchronous induction motor drives the main 500 kW generator which supplies the section drive motors.

The consulting engineers for the power station were J. D. Crozier & Partners, Ltd., and the main civil works were carried out by Holst & Co., Ltd.

Harland drive annexe looking towards the wet end of the drive. The paper board machine is on the other side of the left-hand wall

WAGES POLICY

E.T.U. Conference, Morecambe

FOLLOWING the presidential address by Mr. F. Foulkes, summarised in last week's issue, the first resolution discussed at the annual delegate conference of the Electrical Trades Union at Morecambe urged the Executive Council to secure a guaranteed week for all sections of the electrical industry. A second called for an annual minimum wage in the engineering and shipbuilding industries as a means of compensating for recurring redundancy. Both were carried.

On the employment of women in industry a resolution was passed affirming that the male labourer's rate should be paid "as the first necessary and minimum step towards achieving the rate for the job." Another resolution expressed alarm at the growing practice of engineering employers of putting women on work normally performed by skilled operators. It called upon the membership to exercise "the utmost vigilance to prevent such moves unless the women concerned are paid the skilled rate."

Shift Allowances

A number of matters concerning the electricity supply industry occupied a large part of Tuesday's proceedings. Referring to the loss of social life suffered by shift workers, Reading Supply branch called upon the Executive Council to negotiate for an improved shift allowance. The resolution, which maintained that the allowance should bear some relation to the basic hourly rate, was supported by the Executive Council and carried. Another, however, which suggested an alteration of policy in relation to shift work so that the length of shift and the shift cycle could be adapted to circumstances and agreed locally, was defeated. Mr. J. Humphreys, on behalf of the Executive, said that the objective of the Union was a forty-hour shift week.

A further resolution condemned the Government for the different treatment of workers compared with executives in the nationalised industries. It said that while advocating a wage freeze for the workers, many of whom were receiving less than £10 for a 40-hour week, the Government approved salary increases for executives as from July last year.

Sub-contracting by Area Electricity Boards was criticised by Luton Supply branch, which declared that this practice threatened members in the supply industry with possible redundancy. The mover said that in his area much of the cable laying was handed out to private contractors.

Carlisle branch expressed the view that an immediate increase in wages could be secured out of the profits of the electricity supply industry and the costs of advertising.

A composite resolution on wages reaffirmed opposition to any form of wage freeze, "including attempts to impose standstill periods in applications for wages increases." The motion assured the Executive Council that it had "the backing of the membership in taking appropriate action, including strike action if necessary, to ensure that our living standards are maintained and are not debased."

A national ban on overtime as a means of counteracting redundancy was suggested by Mr. W. J. Carroll, of the Manchester Electronic Engineers. He was supporting a resolution, which was carried, calling for a vigorous campaign against what it described as the policy of "deliberately creating unemployment." The resolution also pledged support to the Executive Council in resisting redundancy. Mr. Carroll said he did not want only a ban on overtime in the E.T.U., but a national one.

Mr. J. Feathers, a National Executive member, speaking on a resolution concerning automation and European Free Trade, declared that the acceptance of the Common Market had led to bigger monopolies being established, particularly in steel and coal. The resolution, calling for the maximum possible co-operation and co-ordination between all unions in the countries concerned in a determined effort to meet all possible attacks on living standards, was carried.

Proposing a resolution on automation, electronics and wages, Mr. A. Murray (Dunston) said that with the introduction of automation many members were finding themselves left behind. There were numerous cases of semi-skilled operators earning 35s or £2 over the rate which members were enjoying. Members were being called upon to maintain machines and systems which were in advance of equipment used only a short time ago. He suggested that they should be taken into consultation on new techniques at factory-floor level.

Mr. S. Goldberg, Executive Council, said it was misleading to imagine automation was being introduced on a gigantic scale. The large sum of money required prevented its widespread introduction. The Executive Council supported every effort to obtain increased shares in the accelerated production of wealth that the techniques brought about.

The conference passed the resolution, which urged that the skilled electricians' rate should be considerably increased as compensation for the extra knowledge and responsibility placed upon them.

Nationalisation was debated on 21st May. The Falkirk branch called on the Labour Party to declare itself in support of nationalisation of all industries "necessary to the interests of the people." It believed it would be wrong to rely on buying a controlling interest as a means of ensuring that any particular industry would be efficient. Supported by the Executive Council, the motion was carried.

A composite motion, supported by 14 branches, called upon the Executive Council to press vigorously for the introduction of a five-day, forty-hour week, without loss of pay, in all sections of the electrical industry.

The mover said they could not present a case for a five-day week while excessive overtime was being worked. His firm had banned overtime, produced more in a shorter work week, and had been able to take on two more electricians.

Mr. J. Hendy, for the Executive Council, said it would continue to press for a five-day, forty-hour week. It was an objective of the whole trade union movement. The motion was carried.

Apprentices in the Contracting Industry

In view of recent developments, conference gave some time to apprentice issues in the electrical contracting industry.

A composite motion viewed "with grave concern the retrograde step taken by the Ministry of Works and the N.F.E.A. by withdrawing from the National Apprenticeship Agreement." It expressed determination to have a national agreement in the industry and pledged full support for the Executive Council in taking such measures as it thought fit, particularly the ban on working with unregistered apprentices, to secure with all possible speed a new and comprehensive scheme. A further composite motion asked that apprentices should be allowed to attend day release classes, with pay, until they reached the age of 21. Both resolutions were carried, and the conference also adopted another, supported by the Executive Council, that the ratio of apprentices should be one to five journeymen. On holidays, the conference agreed that there should be two weeks' holiday with full wages for all grades.

It was stated by the Executive Council that agreement had been reached by the trade union side of the N.J.I.C. on contracting departments of Area Boards. A subcommittee would be formed of one representative from each of the other four unions and five representatives of the E.T.U. Mr. R. G. McLennan said the Boards' side of the N.J.I.C. had accepted the agreed proposals of the unions. Negotiations were proceeding as to the terms and conditions of an agreement to cover all electricians in contracting departments.

Plant Engineers

THE presidential address at the Brighton Conference of the Incorporated Plant Engineers (13th to 16th May) was delivered by Mr. K. S. London who said that their Institution accepted as members not only graduates but also engineers of education, training and experience whose mathematical attainments (befitting those destined for research or technical design) might be insufficient to obtain a Higher National Certificate. Students in the latter category were recommended to obtain the Ordinary National Certificate by the City and Guilds Course 187 in Plant Engineering. The Institution's refresher courses enabled older plant engineers to adapt themselves to the changing pattern of industry.

The necessity for industry to build sound technical training and experience on the basic knowledge provided by universities and technical colleges was emphasised by Mr. H. Birchall (Imperial Chemical Industries). Illustrating the essential requirements of a more scientific approach to work planning than the former tendency to trust rather to improvisation, the author discussed the technical sequence in which plant engineers might take part in carrying out an undertaking and the importance of team work. He also drew attention to the profitability of work study courses.

The replacement of manual and mental energy by mechanical and electrical energy as a first step towards automation was the subject of a paper by Mr. L. L. Goodman (British Electrical Development Association) who submitted that Britain would not be able in the future to find money to invest in industry for a plant utilisation of only 25 per cent or compete with countries having a 50 per cent utilisation basis. Most production operations were divisible into mechanical handling, processing, sensing and control, which should be integrated as far as economically practicable. Mr. Goodman cited numerous instances of contributions which electricity was making or could make to productivity and reduction of costs; e.g. the ratio of cost of a human h.p.-hr and an electrical h.p.-hr was about 400 to 1. From 1924 to 1956 the kWh in British industry purchasable at the cost of an average man-hour increased from 11·2 to 40·6. In the United States the corresponding figures were 39·1 and 220, and the h.p. per worker was now four times higher than here. Most industrial concerns could achieve a higher return on capital invested in the manufacture of goods than in plant for generating electricity, which called also for the specialised technological knowledge and experience possessed by public supply authorities. Many back-pressure plants required an optimum balance between steam and electricity. This could limit the h.p. per worker, since if the plant capacity were adequate to-day it would probably not be so in the near future or if designed to cover later requirements the capital would not be fully employed at present. Sir Christopher Hinton had recently expressed the view that continuance of present trends would make power from nuclear stations cheaper than coal- or oil-fired stations by 1962. By 1982 it might cost half.

The importance of complete instrumentation was emphasised; its cost averaged 6 per cent of the total capital expenditure on new plant, but this additional cost could easily be outweighed by capital economies in other directions.

Installation and Maintenance Problems

AT a recent meeting of the Association of Supervising Electrical Engineers presided over by Mr. G. H. Parker (national chairman), a panel composed of Messrs. W. H. Brooks, J. J. Chase, S. J. Emerson, J. Flood, Forbes Jackson and E. J. Sutton replied to questions concerning electrical installation and maintenance raised by members present or communicated by provincial branches.

Among the subjects discussed was one relating to the varying standards of inspection by Area Boards before connecting up a new or extended installation. It was pointed out in reply that all Boards tested the wiring but not all made a detailed inspection. Most Boards accepted an undertaking by a contractor approved by the National Inspection Council that his work complied with the I.E.E. Regulations. There remained the need to inspect installations put in by contractors not on the roll. Provided an insulation test was satisfactory, a Board would probably be required by statute to give a supply. Compliance with the I.E.E. Regulations would of itself be regarded as evidence of fitness, but these Regulations were not a statutory code and inspectors had no right of entry to a house without the occupant's permission.

The chairman, summing up, said that variations in procedure between the different Boards were considered undesirable and called for some standardisation.

Regarding the need to ensure the correct rating of fuses for domestic appliances connected to B.S. 1363 plugs, over-fusing was reported to be prevalent, which was often dangerous. It was suggested that such apparatus should be marked with the appropriate fuse rating and also the plugs, preferably by the moulding in of instructions.

A question of whether a common neutral could be used for signal lamps for motor starters (one light for each) controlled from a distant point was answered firmly in the negative. A break in the neutral was shown to be liable to cause a dangerous voltage on parts of the circuit normally at or near earth potential.

A query was raised as to whether a conduit could be run underground for containing wiring between a petrol station office and a petrol pump; this was held not to comply with the Regulations.

Some difference of opinion was apparent regarding a communication which stated that the I.E.E. Regulations prevented the use of multi-core cable in which two cores operated at extra-low voltage but permitted cables in like circumstances to be drawn into conduits or ducts, provided all cables were insulated for the highest voltage present. It was agreed that the question should be referred to the I.E.E. for interpretation.

Switzerland's Electrical Trade

IN 1957 Switzerland experienced a year of high economic activity coupled with relative stability. There was, however, some "levelling-off" of boom conditions, and some anxiety about the effect of rising prices on the cost of living, wages, and eventually on Swiss exports. At the turn of the year the Swiss economy appeared to be poised between over-expansion and a danger of recession. The prospect of slackening demand from abroad induced an attitude of caution.

The total value of Switzerland's electrical trade during the year did not vary greatly from that in 1956; imports rose to £16·9 million and exports to £31·8 million. Imports from the United Kingdom, which included electronic equipment, instruments and domestic appliances, amounted to £1·5 million (£1·2 million in 1956) and her exports to the United Kingdom were £1·13 million (£1·18 million in 1956). With her rising standard of living Switzerland should continue to be a good, but discriminating and competitive, market. As in previous years Western Germany was Switzerland's main electrical trade partner. The United States gained a strong foothold in domestic appliances and Switzerland is one of Holland's traditional markets for radio and television equipment.

The Swiss electrical industry was fully employed during 1957 and, despite increased production and the building of new factories, orders in hand average ten to eleven months' production. By the end of the year delivery times were becoming longer, and prices higher partly from the reduction in the working week from 48 to 47 hours. Business in the home market continued at a high level, as a result of the Federal Railways' 10-year improvement plan and the hydro-electric programme.

There was during the year a belated recognition that Switzerland had fallen behind in the field of nuclear energy, and considerable efforts to catch up were begun. It is expected that the country will have to turn to nuclear power when its hydro-electric resources are fully developed, which is estimated to be by 1975. At present there is one "swimming pool" research reactor in operation. Further projects include the construction of a heavy water-cooled and moderated reactor by the Reactor A.G. (Wurlingen); another reactor for the Ecole Polytechnique Federale (Zurich); an experimental power station for the four principal electricity undertakings Suisatom A.G.; a small nuclear power plant by the Energie Nucleaire S.A.; and finally an international experimental reactor planned by the O.E.E.C.

Switzerland's Electrical Imports and Exports, 1957 (000 S.Fr.) (1956 totals in parenthesis)

	Imports	Exports
Steam Engines and Turbines	1,350	40,335
	(856)	(42,656)
West Germany	1,007	3,955
Italy	13	8,091
Belgium/Luxembourg	18	5,657
Holland	2	4,031
Spain	—	4,314
Poland	—	1,263
South Africa	—	1,264
India	—	1,558
China	—	1,804
Mexico	—	1,153
Argentina	—	1,171
Water Turbines and Pumps	15,280	38,145
	(12,943)	(37,955)
United Kingdom	1,149	1,284
West Germany	7,941	7,654
Austria	232	3,051
France	909	2,866
Italy	721	1,507
Belgium/Luxembourg	263	1,753
Holland	314	1,715
Spain	—	1,034
Norway	27	1,161
Sweden	1,066	760
Finland	—	2,106
South Africa	—	1,007
Portuguese West Africa	—	1,026
India	—	1,354
Mexico	—	4,615
Brazil	—	1,740
Chile	—	1,558
Peru	—	1,305
Dynamo-electric Machinery and Transformers	30,169	126,228
	(26,719)	(119,783)
United Kingdom	1,953	3,060
West Germany	19,961	9,221
Austria	826	3,485
France	1,354	8,078
Italy	1,888	3,588
Belgium/Luxembourg	337	6,569
Holland	1,243	9,046
Spain	—	10,961
Portugal	—	5,365
Norway	96	5,791
Sweden	324	5,706
Finland	—	1,147
Egypt	—	1,169
South Africa	—	1,878
French West Africa	—	1,990
Saudi Arabia	—	1,420
India	—	7,069
China	—	2,705
Canada	22	4,238
United States	1,989	4,139
Mexico	—	1,876
Colombia	—	2,855
Venezuela	—	3,223
Brazil	—	2,922
Argentina	—	1,997
Peru	—	3,686
Australia	—	1,015
Electric Locomotives	961	927
	(626)	(1,675)
West Germany	898	258
France	5	480

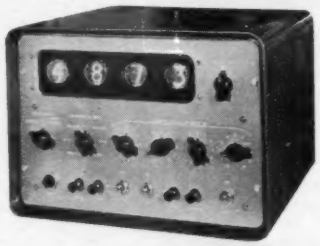
	Imports	Exports
Electric Lorries	1,296	298
	(991)	(536)
United Kingdom	338	—
West Germany	658	4
Holland	—	164
United States	217	—
Refrigerators, up to 100 kg	7,488	2,105
	(7,627)	1,575)
United Kingdom	482	47
West Germany	4,359	249
France	30	427
United States	1,902	31
Ditto, 100-500 kg	5,435	547
	(3,574)	(492)
United Kingdom	207	4
West Germany	1,177	5
Sweden	1,140	20
United States	2,417	—
Cookers and Ranges	3,205	3,227
	(3,269)	(2,631)
United Kingdom	32	760
West Germany	2,852	54
France	21	514
Holland	22	462
Flat-irons	430	178
	(661)	(145)
United Kingdom	116	2
West Germany	302	4
Telephone and Telegraph Apparatus	8,367	15,121
	(6,678)	19,191)
West Germany	4,196	581
Belgium/Luxembourg	3,319	1,366
Holland	423	4,550
United States	112	1,807
Venezuela	—	1,395
Radio Receivers	61,088	23,785
	(49,244)	(24,304)
United Kingdom	3,582	446
West Germany	36,848	804
France	1,602	1,978
Italy	516	1,404
Belgium/Luxembourg	348	1,239
Holland	9,177	3,235
Sweden	143	1,897
Egypt	—	1,140
India	—	1,028
Colombia	—	2,832
Electric Control Apparatus and Measuring Instruments	14,115	36,618
	(10,575)	(33,441)
West Germany	5,669	3,819
France	1,025	2,695
Italy	39	3,371
Belgium/Luxembourg	70	3,625
Holland	758	4,037
Denmark	147	1,368
Norway	—	2,057
Sweden	70	2,104
Czechoslovakia	—	1,154
India	—	1,355
Venezuela	—	2,200
Filament Lamps	6,880	722
	(5,859)	(667)
West Germany	2,012	131
Holland	1,977	17
United States	1,411	102

	Imports	Exports
Electric Lighting and Signalling Equipment for Vehicles	2,435	1,174
	(2,244)	(1,427)
United Kingdom	362	31
West Germany	1,136	14
Ditto, other	4,941	4,695
	(4,911)	(5,368)
United Kingdom	678	127
West Germany	2,500	1,300
France	529	723
Italy	306	650
Czechoslovakia	7	455
United States	862	437
Accumulators	3,772	5,217
	(3,139)	(5,735)
United Kingdom	163	162
Holland	14	598
West Germany	1,890	567
France	662	544
Belgium/Luxembourg	122	683
United States	497	78
Insulators, mounted	2,759	4,289
	(1,243)	(3,210)
West Germany	197	988
France	660	49
Italy	15	376
Belgium/Luxembourg	—	488
Holland	52	649
Spain	—	206
Cables, bare	1,329	2,279
	(1,042)	(3,939)
United Kingdom	142	67
West Germany	1,165	311
Belgium/Luxembourg	—	533
Italy	—	197
Denmark	—	279
Norway	—	274
Cables, p.i. or r.i. without lead sheathing and iron armouring, and insulated wire	3,404	4,745
	(3,213)	(3,781)
United Kingdom	253	37
West Germany	2,616	155
Italy	333	557
Belgium/Luxembourg	7	1,020
Denmark	3	490
Ecuador	—	204
Ditto, with lead sheathing	111	316
	(30)	(354)
Ditto, with lead sheathing and iron armouring	75	1,224
	(98)	(662)
Cables without lead sheathing, covered with overspun	756	1,428
	(676)	(1,505)
Ditto, with lead sheathing	28	48
	(4)	(188)
Instruments, etc., n.e.s.	26,218	135,632
	(18,603)	(125,555)
West Germany	15,583	11,889
Austria	357	5,836
Belgium/Luxembourg	87	8,936
Holland	726	12,972
France	2,154	8,858
United States	3,347	3,354
Sweden	117	8,897
Canada	6	9,267
India	—	5,285

NEW ELECTRICAL EQUIPMENT

Universal Counter

The Type SA.501 counter being produced by RACAL ENGINEERING, LTD., Western Road, Bracknell, Berkshire, is claimed to be the first transistorised universal counter with in-line read-out to be manufactured in this country. It is suitable for laboratory and industrial use for the measurement of frequencies, time intervals, events, batch counting and control; is insensitive to transistor characteristics and component tolerances; and can be mains or battery operated. Power read-out is provided for printing or control processes. A fully variable digital time base gives direct display in desired units.



Racal Type SA.501 universal counter

The SA.501 will count and register up to a maximum of 9999 and will then reset to zero, carrying on in this manner indefinitely. An output pulse is produced each time the reset takes place and this may be used to operate an external register to increase the total count capacity.

Vacuum Cleaner

The new DM.540 cylinder type vacuum cleaner to which we referred earlier this year is now generally available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Of steel construction, it is essentially strong and light and has a "contemporary" appearance. The cleaner's 500 W double-insulated motor, driving a two-stage fan, provides an air flow of approximately 54 cu ft/min which is treble filtered. Throw-away paper dust bags are provided and a pocket in the base of the fabric dust bag can house a deodorising pad. The attachments comprise a floor and wall brush, carpet nozzle, upholstery tool, a cornice brush with removable bristles for cleaning, a crevice nozzle and an unkinkable flexible plastic hose with valve attachment for cleaning rubber-backed carpets.

The extension tubes for the cleaning attachments are of chromium-plated steel and have slotted ends. The lightweight hose is swivelled at both ends and has a suction regulator in the handle. The cleaner is suppressed against interference with radio or television and is supplied with 21ft of 2-core circular flexible. The price, complete with full set of attachments, is £24 7s 6d including purchase tax in the United Kingdom.

Micro Switch

A new version of the V3 micro switch has been introduced by BURGESS PRODUCTS CO., LTD., Micro Switch Division, Dukes Way, Team Valley, Gateshead, 11. The switch mechanism has been completely redesigned but it is physically interchangeable with the original model. The new switch is rated to perform a minimum of ten million operations and, furthermore, it will do this even when plunger movement cannot be tightly controlled. More consistent operating characteristics and improved resilience under shock conditions are two other attributes of the V3 switch. The electrical ratings and operating characteristics have been designed to conform to those of the old V3 switch.

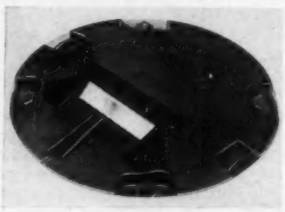
Table Fan

A new type of table fan, 7in in diameter, known as the "Two-Tone," has been announced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It is moulded in polythene and its resilience is such that it can withstand accidental knocks or falls. The fan is equally suitable for domestic or commercial use and despite its relatively small size it is capable of producing an effective air movement.

It is operated by an induction motor and models are available for the 200/230 and 230/250 voltage ranges. There is a choice of three colour combinations, black/yellow, green/white and grey/pink, and the price is £2 19s 10d plus 13s 2d purchase tax in the United Kingdom.

Aircraft Runway Lighting Fitting

A unidirectional high intensity lighting fitting (type CR/22-3S) has been developed from types made for the Air Ministry for use on aircraft runways by HOLOPHANE, LTD., Elverton Street, Westminster, London, S.W.1. Prime considerations for this type are ruggedness and permanence and the shape was chosen to minimise the bump to aircraft tyres. Projection above ground is ¾in and is the minimum consistent with a high light intensity at a low angular elevation.

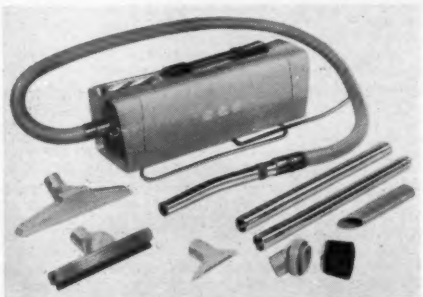


Holophane flush prismatic aircraft runway lighting fitting

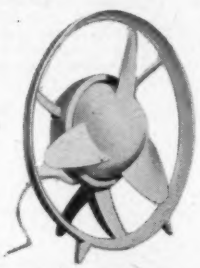
The light beam is emitted at about 2½ deg elevation, with high intensity in the horizontal direction and useful intensity up to about 6 deg elevation. The optical prism is embedded in a cast-iron top to which is attached a cast-iron body enclosing a 12 W 100 V coiled filament lamp and optical system. The system comprises a paraboloid mirror mounted on a cast bronze bridge which forms the prefocus lampholder, and a large reflecting-refracting prism of which the top surface is exposed in the top casting. A spreader glass is mounted below the prism and provision is made for a colour filter. The fitting is provided with an index mark on the optical axis, with marks at 5 deg on each side. The overall diameter of the fitting is 15in and its weight is approximately 100 lb.

Lighting Fittings

A new range of contemporary lighting fittings, manufactured by Kare Nilsen, of Bergen, Norway, has just been placed on the market in this



G.E.C. model DM.540 cylinder type vacuum cleaner complete with accessories



G.E.C. "Two-Tone" table fan

Kare Nilsen model 55-2FL 2-light wall fitting

country. The complete range, competitively priced, comprises wall mounting and ceiling suspension types, desk lamps, floor standards, etc., and, it is claimed, only the highest quality brass, wood and plastics are used in their construction. Typical of the type of fittings available is the model 55-2FL wall light (illustrated), finished in polished brass with partly black enamelled lampholder covers and base. A two-light fitting, it is provided with b.c. lampholders and accommodates two 25 W lamps. An unusual feature of this fitting (and of several others in the range) is that one arm is fixed and the other flexible, thus enabling a number of variations of design to be achieved. The price of the fitting, complete with shades in either parchment or plastic, in various colours, is £2 11s 6d plus 11s 6d purchase tax in the United Kingdom. An illustrated price list giving full details of the range of fittings may be obtained from the distributors in this country, SVERRE ROHRT, 87-89, Coombe Lane, Kingston-on-Thames, Surrey.

Fluorescent Fitting

An anti-corrosive fluorescent lighting fitting, the "Anticor," is the latest product of the STRONG ELECTRIC CORPORATION (GREAT BRITAIN), LTD., Whyteleafe, Surrey.

The fitting consists of a "Perspex" diffuser cover and a polythene treated spine which accommodates the control equipment. The diffuser cover beds

Strong "Anticor" single tube 5ft 80 W fluorescent fitting

securely into an expanded "Neoprene" rubber gasket which completely seals the unit against external atmosphere. The spine is formed from perforated steel sheet which is treated with high density polythene.

Suspension is made with p.v.c. cables through plastic sealing glands or with p.v.c. coated conduit. Clearance holes for ¾in conduit or glands are provided at 40in centres or alternatively the spine can be readily drilled to suit local conditions.

The fitting is available as a single tube 5ft 80 W unit (£20) or as a twin tube 5ft 80 W unit (£24 5s); both prices include control gear but not lamps.

Waste Disposer

One of the latest products of the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, is a kitchen waste disposer capable of accommodating approximately 3½ pt of scraps, including small bones, at one loading.

Hotpoint waste disposer

Scraps fed into the unit are shredded into particles about 1/500in in diameter within 2 min and washed away via the drain outlet. The disposer has 3-bank double-edged shredders. A ¾ h.p. capacitor start motor drives the impeller at 1,425 r.p.m. and is automatically reversed at each operation, a relay providing automatic overload protection. The disposer, which can be operated only when a control cover is locked in place in the "on" position, weighs 37 lb, is 16½in high and the average water consumption is 2 gal per charge. Models are available for the 200/220 and 220/250 V ranges and the price is £37 10s plus £8 4s 7d purchase tax in the United Kingdom.

Barrel Pump Flowmeters

A flowmeter, specially designed for use with portable electric barrel pumps, has been introduced by the BRITISH CENTRAL ELECTRICAL CO., LTD., 6 & 8, Rosebery Avenue, London, E.C.1. It measures the actual quantity of liquid being pumped and not the rate of flow. There are two sizes available, 3½ or 5in dial, calibrated from 0 to 25 gal. The pointer of the dial is easily set to zero for each measurement, but the register shows the total number of gallons pumped. The volumetric principle of measurement ensures that the actual quantity delivered is indicated. In

B.C.E. barrel pump flowmeter

use the flowmeter is normally coupled direct to the outlet pipe on the barrel pump and the delivery coupling is suitable for 1in internal bore hose.

Constructed of die-cast alloy, the flowmeter is claimed to withstand normal industrial usage and contains a built-in filter and non-return valve. It has been designed for use with thin mineral oils or liquids of a similar nature and a modified unit suitable for use with solvents will be available shortly. The respective prices of the two models are £36 4s (3½in) and £45 13s (5in).

CATALOGUES AND LISTS

CABLES.—8-page catalogue (A/21) dealing with "Ovoil" 33 kV oil-filled cables.—**Standard Telephones & Cables, Ltd.**, North Woolwich, E.16.

CAPACITORS.—20-page catalogue (401) describing power capacitors for operation at 200 to 600 V.—**British Insulated Callender's Cables, Ltd.**, 21, Bloomsbury Street, London, W.C.1.

CONDUIT FITTINGS.—Price list (16) giving the latest figures for the company's range of conduit fittings and a leaflet describing an insulated adjustable lug plaster depth switchbox.—**F. C. Blackwell & Co., Ltd.**, "Blaco" Works, Great Crosby, Liverpool, 23.

DIELECTRIC FLUIDS.—50-page booklet giving particulars of "Aroclors" and "Pyroclor" dielectric fluids and describing their use in capacitors and transformers.—**Monsanto Chemicals, Ltd.**, Monsanto House, 10/18, Victoria Street, London, S.W.1.

FILTERS.—Illustrated 16-page catalogue (W1031) dealing with the company's filters for insulating oils.—**Stream-Line Filters, Ltd.**, Ingate Place, London, S.W.8.

REFRIGERATION.—Leaflet illustrating and describing a self-contained refrigerated shelf for bottle cooling.—**G.V.E., Ltd.**, Thanet House, 231, Strand, London, W.C.2.

SAFETY EQUIPMENT.—12-page illustrated catalogue giving particulars of welding goggles and shields and other eye and face shields.—**J. & R. Fleming, Ltd.**, 146, Clerkenwell Road, London, E.C.1.

SWITCHBOARDS. — Illustrated leaflet (L.S.2000) dealing with load centre switchboards for providing a central control for all distribution and motor circuits.—**Lancashire Dynamo Nevelin, Ltd.**, Hurst Green, Oxted, Surrey.

WIRING ACCESSORIES. — Broadsheet giving prices, particulars and illustrations of the company's range of lampholders, switches, socket outlets and other wiring accessories.—**Nettle Accessories, Ltd.**, Harper Road, Wythenshawe, Manchester.

GENERATION AND DEVELOPMENT

Off-Peak Campaign

To draw attention particularly to the off-peak uses of electricity the Eastern Electricity Board has arranged a small but attractive exhibition which will be shown to local committees of the Consultative Council and Press representatives in various parts of the area. On Friday last it was staged at the Queen's Hotel, Westcliff, where it was seen by members of the Essex Committee.

Mr. H. V. Pugh, chairman of the Board, said that the idea was largely due to Alderman Bennett, the chairman of the Consultative Council. The purpose of the exhibition was to show a few of the 101 ways in which electricity could be used to lighten housework and make homes more comfortable; at the same time they wished to show how, by transferring some of the load away from the peak hours—such as by off-peak water and space heating—consumers could help to make the generation of electricity more economic.

In a short review of the duties of Consultative Councils, Ald. W. J. Bennett pointed out that while they had naturally to deal with complaints, a major part of their work was in the discussion of the plans, policies and tariffs of their Boards; they existed in partnership with the Boards to bring well-informed lay thought and opinion to bear upon the supply industry's problems as they affected consumers.

I.O.M. Plant Extensions

Having considered a report from its consulting engineers, Messrs. Kennedy & Donkin, on the urgent need for additional generating plant at Pulrose power station, Douglas (I.O.M.) Corporation Electricity Committee recommends that the extension should be proceeded with as quickly as possible. It is hoped that the first set can be commissioned by next spring and the second set by the spring of 1960. The estimated cost is £166,100.

Rates on Boards' Offices

In a report on the Local Government Bill a joint sub-committee of the Association of Municipal Corporations refers to representations made by the Association that offices of gas and electricity boards, other than those situated at gasworks or generating stations, should be treated on the same basis as showrooms. In reply the Ministry of Housing and Local Government had stated that the Minister could not accept that the proposal to rate directly gas and electricity showrooms—which was being undertaken solely because of their relation to retail shops—carried with it any necessity to reconsider the rating of the offices of the undertakings. There would be no justification for singling out for separate treatment those particular parts of undertakings whose rate liabilities were assessed as a whole, nor did it follow that the amount of the overall assessments which might reasonably be attributable to offices would coincide with the values which might be assigned to them if separately assessed.

The joint sub-committee states that it is disappointed by the reply, believing that the failure to rate offices separately from operational premises of the boards is most unfair, and proposes to endeavour to secure an amendment of the clause.

Councils Oppose Supergrid Line

A public inquiry was held at Kingston-upon-Thames last week into an application by the Central Electricity Generating Board to erect a 275 kV line between West Weybridge substation and a substation proposed to be erected at Chessington. Opponents of the scheme included the Esher, Woking and Chertsey Urban District Councils. The inquiry was conducted by Mr. H. W. Grimmitt, chief engineering inspector of the Ministry of Power, and Mr. W. A. Devereux, senior inspector of the Ministry of Housing and Local Government.

Mr. S. B. R. Cooke, for the Electricity Board, said the line would be about 9½ miles long and would have some 49 supporting towers. The cost of an overhead line was about £25,000 a mile while the estimated cost of putting it underground was £380,000 a mile. While the proposed line would cross Esher Common, on paper that could look very much worse than in practice, because in practice one could see the amount of cover available and the comparatively small section affected.

An alternative route to the south was equally strenuously opposed by objectors. Witnesses stated that it would seriously damage such amenities as the historic church at Stoke d'Abernon and the manor house.

New Lighthouse

The North of Scotland Hydro-Electric Board has connected to its mains the newly built lighthouse at Strathey Point on the Pentland Firth, 20 miles west of Thurso. The 1,000 W lamp produces a beam of 1,600,000 c.p.

Electricity, which is brought to the lighthouse from a tapping on the Board's 33 kV line running along the Pentland Firth coast, is also being used to operate lifting equipment and pumps. The three lighthouse keepers' houses are all-electric.

Cookers for Council Houses

The sum of £1,000 is to be made available initially by York City Housing Committee to buy a small supply of cookers for hiring to tenants who are unable to undertake hire purchase agreements with the Gas and Electricity Boards. A scheme is to be introduced whereby cookers are supplied directly by the Boards instead of by the builder as part of his contract.

With two 30 ton winches pulling on the lifting girdle, and the base trailing on a steerable trolley, the second 125 ton heat exchanger of No. 1 reactor is hauled into its final vertical position at the nuclear power station now under construction at Berkeley, Gloucestershire. The heat exchanger, 82ft high and containing 150 miles of tubing, is one of eight for the reactor. The Berkeley project, which is being carried out for the C.E.G.B. by the A.E.I.-John Thompson Nuclear Energy Co. Ltd., is due for completion in 1960-61, when the station will have a minimum net output of 275 MW

Financial Section

STOCKS and SHARES

WITH the half per cent decrease in Bank Rate to encourage them, Stock Exchange markets reached Whitsun in very fair shape, prices in both the gilt-edged and industrial sections being not much below the best of the year. Concern over foreign affairs has, however, been a main factor in restraining the development of much activity. Timing of the Bank Rate cut was a little unexpected, but the decision had been anticipated too widely for its impact to have any great effect. Company news has included interesting dividend and profits announcements from several of the engineering firms who are partners in the principal atomic power development groups.

Engineering Results

John Thompson are bringing the dividend for 1957 to a total of 25 per cent, which is the same as on the two previous occasions but applies this time to capital increased to nearly £2·1 million by last year's issue of just over a million new shares. At that time the company also increased the borrowing powers to £5 million in view of the large capital expenditure commitments in connection with atomic power and other projects: orders on hand were stated last July to exceed £38 million. Profits for 1957 are reported to be rather less than before. After these statements the 5s shares were little altered at 25s, the yield at this price being 5 per cent. Richardsons Westgarth 10s shares were steady at around 14s 6d following the company's announcement of a net profit slightly above the previous figure and the effective maintenance of the dividend at a total equivalent to 8½ per cent on the present capital, which was doubled by a scrip issue during the year. The yield on the 10s shares works out at 5¾ per cent.

Dividends Declared

Head Wrightson 5s shares moved up to 19s 3d after news of a further expansion of some 16 per cent in the company's net group profit for the past year, and of an improvement equivalent to 2½ per cent in the dividend, which is being brought up to a total of 17½ per cent. On the new rate, the shares show a yield of 4½ per cent. For seven years in succession the growth of the business has enabled the company to raise the shareholders' return, without departing at any time from a strictly conservative financial policy. From the preliminary figures it appears that the current payment will leave three-quarters of the disposable surplus of profits to go back into reserves. Reliance Clifton 5s shares improved to 11s 3d (and the "A" shares to 10s 9d) on the company's decision to raise the dividend from 13½ to 15 per cent for 1957. Profits are stated to be below the previous results, but they still provide very ample cover for the higher payment, on the basis of which the shares yield about 6¾ per cent.

Because of the Whitsun holiday we are unable to publish our share list. It will appear as usual in next week's issue

Murphy Radio

There has been good support for the 5s shares of Murphy Radio since the appearance of the annual report and the recently held annual meeting. They have been standing at around 12s 9d to yield a fraction over 7¾ per cent on the basis of the 20 per cent rate of dividend paid for the last four years, each of which has produced an improvement in earnings. In 1957 the net profit, after tax, rose from £236,000 to £267,000, and there is now more than twofold cover for the ordinary dividend. In the report, the company was stated to have secured an increased proportion of an enlarged market for domestic receivers, and the chairman referred to the satisfactory progress of the company's broadening interests in the fields of electronics and nucleonics. Issued ordinary capital of the company is £910,000.

Ever Ready Results

Expectations were well satisfied with the Ever Ready Company's results for the year ended on 1st March. With net profits showing a further moderate improvement, shareholders are to receive a larger distribution for the second year in succession. Dividends totalling 20 per cent for 1957-58 are payable on capital doubled, by a scrip issue, to just over £3 million, and represent in effect a rise of 1¼ per cent on the previous year's rate. From the preliminary figures, the new rate is calculated to be covered rather more than two and a half times by the distributable surplus, and produces a yield of 6 per cent on the 5s shares at their recent price of 16s 9d.

Wolf Electric

Financial results of Wolf Electric Tools (Holdings) for 1957 showed a minor check to progress, but the decline in trading profits was limited to 8 per cent and created no difficulty over the maintenance of the dividend at 10 per cent on capital doubled by a scrip issue since the previous payment of 20 per cent. It involves the distribution of well under one-third of the net surplus, and provides a yield of nearly 7½ per cent on the 5s shares at a price of 6s 9d. Contraction of profit margins was stated in the report, issued last month, to have been particularly severe in overseas markets. At the start of the current year, sales in the domestic market were reported to have shown some decline, although industrial output had been maintained, and there were plans on hand for new developments.

Preference and Debentures

The newly issued Pye 6 per cent debenture stock 1975-81 has been quoted in the market at a premium of 1½ points on the price of 98 at which it is offered to the company's shareholders. A second instalment of £25 per cent is due to be paid on 6th June. In the lists of preference shares on offer, first-class issues provide the buyer with yields of a little over 6 per cent. Among them may be mentioned A.E.I. 4½ per cent preference at 14s 9d, and the same company's 8 per cents at 25s 9d, also the 6½ per cent shares of English Electric at 21s 3d and G.E.C. at 20s 9d. Returns of nearly 6½ per cent are shown on the 5 per cent shares of Atlas Electric, Crabtree Electric and Hackbridge Holdings, all available at about 15s 6d. Ferranti 5½ per cents at 16s give over 6½ per cent, and on Johnson & Phillips 4½ per cents, at 12s, the yield is 7½ per cent.

Bylock Electric

The 1s ordinary shares of Bylock Electric have been quoted recently at about 3s 1¼d, and the non-voting "A" shares at a fraction lower. At the last annual meeting of the company the chairman was able to report a substantial expansion of the business in the 1956-57 period. An improvement of £53,000 in the net group profit to £132,000 (before tax of £78,000) made it easily possible for the dividend to be maintained at 33⅓ per cent, the same rate as before but on capital subsequently increased by 50 per cent through a scrip issue. As Mr. Mathers observed, the accounts were completed before the intensification of the credit squeeze, which subsequently made conditions more difficult in some respects, but he was speaking before the introduction of the purchase tax changes. Turnover in the early part of the current year had kept up well, and he mentioned plans in hand for maintaining the figures. There is a yield of about 10½ per cent on the shares.

Diesel Engines at Chapel Cross

Eight Crossley 500 kW diesel engined automatic standby generating sets are being installed at the United Kingdom Atomic Energy Authority's nuclear power station at Chapel Cross. There are four separate engine-rooms, one per reactor, each housing two sets. The engines are Crossley "HSN" six cylinder two-cycle scavenge pump diesel engines, with a bore of 10·5in and a 13·5in stroke, each direct coupled to a Brush 240 V d.c. generator.

REPORTS and DIVIDENDS

The London Electric Wire Co. & Smiths, Ltd.—The annual meeting was held on 22nd May, Mr. E. L. Wildy (chairman) presiding. In the course of his address Mr. Wildy said that the equipment at their factories was now up to date and, although a certain amount of new plant continued to be installed their main expansion programme, started in 1954, was substantially completed in 1957. Productive capacity was, therefore, rather greater than in 1956, but the total volume of output in the year was approximately the same. In spite of improved methods of manufacture they had been able to absorb only a part of the increased costs and had had to increase the selling prices for certain of their products. On the other hand, customers derived benefit from the fall in the price of copper. Some of the price increases were introduced too late to have much effect on the year's results.

The research and development section had been considerably strengthened by the introduction of new personnel and increased activity in this direction had brought with it the need for improved facilities, and a new three-storey building was nearing completion at the Leyton factory. Their subsidiary company, the Liverpool Electric Cable Co., Ltd., succeeded in increasing the volume of output and, in spite of depreciation in the value of raw materials, made a reasonable profit. Referring to the fluctuations in the price of copper, the chairman said that the persistent fall in price had made for uncertainty in the trade and had been a factor in the short order books on which they had been recently operating. Regarding the future, the demand for their products and the trading profit of the group in the early months of the current year had at least been maintained by comparison with 1957.

Hopkinsons, Ltd.—The annual meeting was held on 22nd May, Mr. R. L. Brown (chairman) presiding. In the course of his review for 1957, which had previously been circulated, Mr. Brown said that the volume of orders received was running at a high level and works output and sales achieved record figures. Export sales had increased by approximately 30 per cent. The two new extensions referred to last year had been completed and they were now receiving benefit of increased output from the plant for the production of forged steel valves, and during the current year output from the heavy machining and fitting shop would commence. In addition to the orders for heat exchanger mountings and valves for the Bradwell, Berkeley and Hunterston nuclear power stations they had received orders for large bore "Tansphere" valves for controlling high temperature gases on reactors at Bradwell and Hinkley Point. Fielden Electronics, Ltd., had had a satisfactory fifteen months' trading. Considerable research work on new designs had been carried out, which when developed on a production basis, should enable the company to reap considerable benefit in the future.

Richardsons, Westgarth & Co., Ltd., reports that subject to completion of audit, the group profit for the year ended 31st March last is £1,470,000, as compared with £1,358,000 for 1956-57. It is stated that the profit includes £156,000 attributable to the inclusion of the Humber Graving Dock & Engineering Co. for the full year (nine months) and Parsons Marine Turbine Co. for the full year (nil), and is after charging increased depreciation and expenditure on atomic and other technical developments. Taxation requires £811,000, and the net balance is £659,000 (against £656,000). It is proposed to pay a final dividend of 5 per cent (against 10 per cent) on doubled capital, making 11¼ per cent (16⅔ per cent) for the year.

John Thompson, Ltd.—The group trading profit for 1957 amounted to £2,411,055, as compared with £2,550,961 for 1956, and after deducting £1,114,524 for taxation, the net profit is £783,851 (against £939,049). It is proposed to pay a final dividend of 15 per cent, maintaining the distribution for the year at 25 per cent, but the dividend is payable on ordinary capital increased by a one-for-seven "rights" issue.

Enfield Rolling Mills, Ltd.—The Earl of Verulam (chairman), presided at the annual meeting held on 21st May. In his circulated review of 1957 he said that the output of copper wire rods by the parent company was well maintained. The drawing mill had a busy year and the sheet and strip mill was working at about three-quarters of its full capacity. Referring to the fluctuations in the price of copper, the chairman said that high prices encouraged substitution, but very low prices were not without their dangers. It took many years to bring a new copper mine into production, and it was often not possible to finance such a new mine unless the copper price was profitable.

W. Canning & Co., Ltd.—The annual meeting was held on 20th May, Sir Ernest R. Canning (chairman) presiding. In his statement, circulated with the report and accounts for 1957, the chairman said that the decline in sales of consumable materials in the early months of 1957 was arrested later in the year and was followed by an improvement. Total sales for the year reached approximately the same level as in 1956. Turnover for the first quarter of the current year had been maintained. In common with other concerns engaged in engineering, their engineering works had in recent years enjoyed an over-full order book, enabling them to maintain production at a high level. This situation had now changed and the demand for capital goods had shrunk. Incoming orders were not matching completed orders. They were continuing their policy of expansion and consolidation, and were now beginning to feel the benefits of the reorganisation. They were also continuing to devote much money and considerable effort to research.

The Anglo-Portuguese Telephone Co., Ltd.—In the course of his review of the company's activities, circulated with the report and accounts for 1957, Sir Alexander Roger (chairman and managing director) said that shipments of plant and equipment from the United Kingdom to Portugal during the year amounted to £554,698 and materials purchased in Portugal amounted to £503,701. The year saw the successful conclusion of the company's 4-year expansion plan. This envisaged the addition of 69,000 stations to the system in Lisbon and Oporto, but the demand made it necessary to increase this to 75,000 stations, and there was still a waiting list at the end of 1957 of 6,608. The highlight of 1957 was the simultaneous introduction into service of two automatic exchanges, Amoreiras and Castelo. Referring to finance, Sir Alexander mentioned the "rights" issue in June last year and said that in April this year arrangements were made with a consortium of banks in Portugal to offer the public in two parts, in April and October, a second series of escudos 80 million 5 per cent obligations at par. This issue would produce almost £1,000,000 to provide further telephone plant and equipment.

The Power Securities Corporation, Ltd.—The annual meeting will be held on 11th June. In his circulated statement, Sir Andrew M. MacTaggart (chairman and managing director) says that Balfour Beatty & Co., Ltd., the principal engineering and construction company, has been fully occupied during the past year, both in the United Kingdom and overseas. At home the Staythorpe "A" (360 MW) and Carmarthen Bay (345 MW) stations, which they constructed for the C.E.G.B., went into commission last year; construction of the Staythorpe "B" station, comprising three 120 MW turbo-alternator sets, started in April last year, and substantial progress has been made with the civil engineering work. In the nuclear power field, in which they are associated with the A.E.I.-John Thompson Nuclear Energy Co., work on the Berkeley power station has made good progress, and they were generally ahead of programme after the first full year of construction. The Transmission Line Department has

completed some 464 miles of h.v. and 120 miles of l.v. lines in the United Kingdom, and it has in hand for the various electricity supply authorities about 820 miles of h.v. and 162 miles of l.v. lines. Much of this work is held up on account of wayleaves. Overseas, the British Columbia Electric Co., Ltd., has appointed them as consultants for the mechanical and electrical work and overall design of the Burrard thermal power station. This station will have a total capacity of over 900 MW and six boiler units which will be fired by natural gas. Sir Andrew mentions work which is in hand in Iraq, Malaya, Kenya and Tanganyika and briefly refers to the activities of the subsidiary and associated companies.

The Pulsometer Engineering Co., Ltd.—The annual meeting was held on 21st May, Mr. F. B. Duncan presiding. After reviewing the activities of the subsidiary companies, Mr. Duncan, in his circulated statement, said that during 1957 their main effort had been to increase the output of the group by expansion of factory capacity and the introduction of new plant, which was already beginning to show a considerable benefit. The order book remained good and with the improved deliveries they believed they would maintain their order position.

The Globe Telegraph & Trust, Ltd.—Application has been made to the Capital Issues Committee for consent to a scrip issue of one 5s ordinary share for every twelve 5s ordinary stock units, and also to raise a further £500,000 of capital by way of a rights issue at par also on a one-for-twelve basis. The directors state that any new shares which might be issued will not participate in any dividends for the year ending 30th June next.

Reliance-Clifton Cables & Industrial Products, Ltd.—The group trading profits for 1957 amounted to £351,505, as compared with £404,141 for 1956, to which is added other receipts totalling £69,588. Taxation absorbs £195,391 and the net profit is £184,386 (against £211,031). It is proposed to pay a final dividend of 9 per cent (against 8 per cent) on the ordinary and "A" non-voting ordinary stock, making 15 per cent for the year (against 13½ per cent).

Turner & Newall, Ltd., has declared an interim dividend of 5 per cent (unchanged) on double capital. It is stated that the interim dividend has been increased—by maintaining the 5 per cent rate on the double capital—in order to reduce the disparity between the interim and final dividends.

The Ever Ready Co. (Great Britain), Ltd., reports that after providing £992,204 for taxation, the group net profit for the year to 1st March last is £934,099, as compared with £892,624 for the preceding year. It is proposed to pay a final dividend of 15 per cent (against 27½ per cent), making 20 per cent (37½ per cent) for the year on doubled capital.

Parnall (Yate) & Radiation, Ltd.—These two companies have notified the Parnall shareholders of the proposed terms of merger. It has been decided that the best method is for Radiation, Ltd., to acquire the whole of the £750,000 issued ordinary stock of Parnall (Yate). It is proposed that Parnall stockholders shall receive for every two 5s stock units, 12s in cash and one fully-paid ordinary share in Radiation, Ltd. The Parnall directors recommend the acceptance of this offer. Of the four Parnall directors who it is intended shall join the Radiation board, three are full-time executive directors, including Mr. F. P. S. Stammers, who will become managing director of Radiation, while retaining the similar position which he already holds with Parnall.

New Companies

B.C.B. Electrics (Harrow), Ltd.—Registered 30th April. Capital £1,000. Manufacturers and distributors of, agents for, wholesale and retail dealers in electrical goods, radio and television receivers and accessories, etc. Directors: E. T. Cain, J. S. Brett and C. Bigland (secretary). Regd. office: 10b, Colin Parade, Sheaveshill Avenue, Hendon, N.W.9.

Frankish & Bell, Ltd.—Registered 1st May. Capital £3,000. To acquire the business of electrical contractors carried on by G. Bell at Manchester as Frankish and Bell, etc. G. Bell is permanent director. Regd. office: 3, Upton Street, London Road, Manchester, 1.

G. Bonham, Ltd.—Registered 1st May. Capital £10,000. To acquire the business of an electrician and television and radio dealer carried on by G. Bonham at 45 and 46a, Old Town Street, Plymouth. Directors: G. Bonham, Mrs. Phyllis A. Bonham and Mrs. Alice L. M. Lewis. Regd. office: 45, Old Town Street, Plymouth.

Wilson Heating & Electrical Co., Ltd.—Registered 12th May. Capital £5,000. Heating, ventilating and domestic engineers, etc. Mrs. Mildred A. Wilson is the first director. Regd. office: 10, Jesus Lane, Cambridge.

Bankruptcies

C. W. A. Hales, residing and lately carrying on business at "Robden," Hoyal Road, Hamworthy, Dorset, electrical engineer.—Public examination 16th July at the Law Courts, Stafford Road, Bournemouth.

T. Evans, 25, North Parade, Aberystwyth, trading as Tom Evans Electricals, electrical engineer.—Trustee, Mr. G. H. Down, 106, Walter Road, Swansea, appointed 9th May.

J. R. Short, c/o 23, Primrose Street, South Hylton, near Sunderland, formerly carrying on business at 11, Rutland Avenue, Bishop Auckland, electrical contractor.—Last day for receiving proofs for dividend 2nd June. Trustee, Mr. N. Saddler, Clarendon House, Clayton Street West, Newcastle upon Tyne, 1, Official Receiver.

E. Webb, of and lately carrying on business at 10, Alderley Street, Macclesfield, Ches., as an agent for electrical appliances.—Last day for receiving proofs for dividend 5th June. Trustee, Mr. W. H. Meredith, 12, Lonsdale Street, Stoke-on-Trent, Official Receiver.

G. Moore, lately carrying on business under the style of the Electric Meter Co., at 123, Hele Road, Torquay, and 2, Barnhill Road, Torquay, electrical engineer.—Last date for receiving proofs for dividend 3rd June. Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

Liquidation

Etherington & Partners, Ltd., electrical manufacturers, wholesalers, factors, etc., Room 15a, Grosvenor Mansions, 82, Victoria Street, London, S.W.1.—Last day for receiving proofs for dividend 31st May. Liquidator, Mr. A. T. Cheek, Official Receiver and Liquidator, Inveresk House, 346, Strand, London, W.C.2.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 2nd June

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Centre. Annual general meeting.

ILFORD.—Angel Hotel, 7.30 p.m. A.S.E.E. North East London Branch. Annual general meeting.

LEEDS.—Great Northern Hotel, 7 p.m. A.S.E.E. Leeds Branch. Annual general meeting.

SHEFFIELD.—Royal Victoria Station Hotel, 7.15 p.m. A.S.E.E. Sheffield Branch. Annual general meeting.

Tuesday, 3rd June

ELTHAM.—Eltham Green School, Queenscroft Road, 7.15 p.m. A.S.E.E. South East London Branch. Annual general meeting.

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7 p.m. A.S.E.E. West London Branch. Annual general meeting.

LONDON.—At the Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2, 7 p.m. Incorporated Plant Engineers, London Branch. Debate on "In Planning a New Factory the Plant Engineer and not the Architect should have the Final Authority."

Wednesday, 4th June

HARRINGAY.—Queen's Head, 677, Green Lanes, N.4, 7.15 p.m. A.S.E.E. North London Branch. Annual general meeting.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. A.S.E.E. Manchester Branch. Annual general meeting.

NOTTINGHAM. — At the Nottingham Mechanics' Institution, Trinity Square, 7.15 p.m. A.S.E.E. Nottingham Branch. Annual general meeting.

PRESTON.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. Annual general meeting.

Wednesday, 4th June, to Saturday, 14th June

PARIS. — Conférence Internationale des Grands Reseaux Electriques (C.I.G.R.E.).

Thursday, 5th June

SOUTHAMPTON.—Polygon Hotel, 7 p.m. A.S.E.E. Southampton Branch. Annual general meeting.

Friday, 6th June

BRISTOL.—Grand Hotel, Broad Street, 7.45 p.m. A.S.E.E. Bristol and West of England Branch. Annual general meeting.

LIVERPOOL.—Liverpool Engineering Society, 9, The Temple, 24, Dale Street, 6.30 p.m. A.S.E.E. Liverpool and District Branch. Annual general meeting.

STOKE.—Grand Hotel, Hanley, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. Annual general meeting.

The Bank of London & South America

employ OTTERMILL

cubicle switchboards

Architect: Victor Heal & Smith, F/F.R.I.B.A.
Electrical Contractors: Drake & Gorham (Contractors) Ltd.

OTTERMILL SWITCHGEAR LTD.

SALES OFFICE: 1 VICTORIA STREET LONDON S.W.1.

Telephone: ABBEY 5095/6 Telegrams: BUSBAR SOWEST

WORKS: OTTERY ST. MARY DEVON · TELEPHONE: OTTERY ST. MARY 264 · TELEGRAMS: BUSBAR OTTERY ST. MARY

P4581

Our organisation is at your disposal

LIGHTING AND POWER INSTALLATIONS.
COMPLETE INDUSTRIAL ELECTRIFICATIONS.
REPAIRS AND REWINDS OF ALL TYPES OF ELECTRICAL EQUIPMENT.
INSPECTION AND MAINTENANCE OF ALL TYPES OF ELECTRICAL PLANT.
HEATING AND VENTILATION SCHEMES.
ELECTRIC MOTORS AVAILABLE FROM STOCK.
ELECTRICAL SPECIALISTS IN ALL BRANCHES OF THE PRINTING AND ALLIED TRADES.

BURDETTE & CO. LTD.

Electrical and Mechanical Engineers and Contractors

Head Office:

150 CLAPHAM MANOR STREET
LONDON, S.W.4
MACAULAY 4555 (P.B.X.)

Main Works: STONHOUSE STREET, S.W.4

Branch Works:

219 Blackfriars Road, S.E.1. Waterloo 4572

OFFORD STREET WORKS, N.1. North 4031

BURDETTE'S *Electrical Services*

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 4th June from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

13228. Kolster-Brandes, Ltd.—Television systems. 29th April, 1955. (796012.)

20015. English Electric Co., Ltd.—Electrical fuse gear. 1st July, 1955. (795923.)

20211. Microcell, Ltd., and Kremer, H.—Tubes or conduits. 27th June, 1955. (795924.)

23108. Landis & Gyr Akt.-Ges.—Method of central remote control. 9th August, 1954. (795954.)

25170. Varian Associates.—Thermionic tube and method of making same. 30th August, 1954. (796045.)

26916. Sylvania Electric Products, Inc.—Electric gaseous discharge devices, methods of coating the envelopes of such devices, coatings of luminescent material on supports therefor and coating suspensions including luminescent material. 16th September, 1954. (796092.)

30489. Sperry Rand Corporation.—Signal responsive systems. 22nd October, 1954. (796056.)

31038. Krautkramer, J., and Krautkramer, H.—Ultrasonic testing apparatus. 27th October, 1954. (796150.)

36873. Marconi's Wireless Telegraph Co., Ltd.—Radio drift and speed indicators for use on aircraft. 26th August, 1955. (796040.)

1955

1284. Electric & Musical Industries, Ltd.—Machines for winding wire. 13th January, 1956. (795865.)

8471. Hazeltine Corporation.—Image reproducing system for a colour-television receiver. 23rd March, 1955. (Addition to 784055.) (796059.)

9935. General Electric Co., Ltd., and Drybrough, D. A. S.—Frequency changers. 23rd March, 1956. (796017.)

10820. Hunt (Capacitors), Ltd., A. H.—Electrical capacitors. 16th April, 1956. (796098.)

11163. Hoover, Ltd.—Single-phase electric induction motors. 17th April, 1956. (796099.)

11830. British Transport Commission, and Dell, R.—Inductor generators. 2nd March, 1956. (796062.)

12005. Philco Corporation.—Transducers. 26th April, 1955. (795962.)

12390. Whipp & Bourne, Ltd., and Whipp, F. E.—Electric air circuit-breakers having arc extinguishing means. 27th April, 1956. (796101.)

13505. Wolff, H.—Junction boxes and the like. 8th August, 1956. (795873.)

15076. Western Electric Co., Inc.—Electrical communication systems. 25th May, 1955. (795876.)

15256. British Thomson-Houston Co., Ltd.—Devices for amplifying or converting radiation. 14th May, 1956. (795877.)

19053. Rotherham & Sons, Ltd.—Mechanism incorporating a time-delay device. 29th June, 1956. (795884.)

20320. Express Lift Co., Ltd.—Lift control systems. 12th July, 1956. (795885.)

21217. Soc. Technique pour l'Industrie Nouvelle Soc. Anon.—Electrically operated remote control system. 22nd July, 1955. (796160.)

21328. General Electric Co., Ltd.—Vibratory conveyors, screens or the like apparatus. 20th July, 1956. (796161.)

21588. Telephone Manufacturing Co., Ltd.—Electrical plug and socket connectors. 25th October, 1956. (796163.)

21639. United Kingdom Atomic Energy Authority.—Nuclear power reactors. 25th July, 1956. (796164.)

22863. Napier & Son, Ltd., D.—Electric commutators. 23rd July, 1956. (796022.)

23407. Electric Machinery Mfg. Co.—Sensitive electrical control circuit using electrostrictive relay. 15th August, 1955. (796064.)

23709. Philips Electrical Industries, Ltd.—Packings for flash lamps. 17th August, 1955. (795930.)

24074. Dow Chemical Co.—End box for a mercury cathode electrolytic cell. 22nd August, 1955. (796142.)

24165. Dow Chemical Co.—Mercury cathode electrolytic brine cell. 22nd August, 1955. (796143.)

24478. General Electric Co.—Cooking appliances. 25th August, 1955. (796169.)

25137. Philips Electrical Industries, Ltd.—Methods and devices comprising a closed ferro-magnetic circuit having a high remanence. 1st September, 1955. (796170.)

25525. Licentia Patent Verwaltungs-Ges.—Electrically controlled reverse gear drive. 6th September, 1955. (796171.)

26838. Electricals, Ltd., and Shortt, J. S.—Electric connectors incorporating cable glands. 10th September, 1956. (796174.)

27631. Sperry Rand Corporation.—Apparatus for checking the time delay between earlier and later pulses. 28th September, 1955. (796178.)

28138. Morgan Crucible Co., Ltd.—Bearings and electrical contacts. 27th September, 1956. (796179.)

30727. Pirelli-General Cable Works, Ltd.—Stranded conductors and apparatus for their manufacture. 9th May, 1956. (796186.)

30868. Licencia Talalmanyokat Erte-Kesito Vallalat.—Cooling towers. 28th October, 1955. (796106.)

30905. Western Electric Co., Inc.—Travelling-wave tubes. 28th October, 1955. (795863.)

30904. Western Electric Co., Inc.—Transmission line coupling devices. 28th October, 1955. (795862.)

31772. Collins Radio Co.—Electrical remote control systems. 7th November, 1955. (795976.)

36577. Kindler Electric Co., Ltd., and Jones, R.—Electrical appliance for igniting fuel fires. 6th December, 1956. (Cognate application 36578, 21st December, 1955.) (795984.)

1956

1989. Standard Telephones & Cables, Ltd.—Electrical remote supervisory apparatus. 20th January, 1956. (796196.)

2531. Edwards High Vacuum, Ltd.—Vapour vacuum pumps. 22nd January, 1957. (795895.)

3725. Square D Co.—Mechanically operated electrical switch devices. 7th February, 1956. (796111.)

5779. Soundscriber Corporation.—Dual channel magnetic tape recorder. 24th February, 1956. (796074.)

7172. Philips Electrical Industries, Ltd.—Heterodyne mixing circuits. 7th March, 1956. (796075.)

9586. Eltro Akt.-Ges. Fuer Strahlungs-Technik.—Photo-electric condensers and processes for the production of such condensers. 27th March, 1956. (796114.)

9665. General Electric Co.—Electronic control switch. 28th March, 1956. (795897.)

14704. Standard Telephones & Cables, Ltd.—Automatic frequency control in superheterodyne frequency shift telegraphy receivers. 11th May, 1956. (796029.)

16677. Westinghouse Electric International Co.—Automatic electric circuit-breakers. 30th May, 1956. (796080.)

16998. Standard Telephones & Cables, Ltd.—Electric pulse communication system. 1st June, 1956. (796081.)

18929. Dictaphone Corporation.—Dual push-button safety control system for machines. 19th June, 1956. (795996.)

19382. Zenith Radio Corporation.—Methods of manufacturing colour cathode-ray tubes. 22nd June, 1956. (795908.)

20163. Kolster-Brandes, Ltd.—A.M. or F.M. radio receiver detector circuit. 29th June, 1956. (796082.)

22038. Standard Telephones & Cables, Ltd.—Circuit arrangement for producing saw-tooth currents. 17th July, 1956. (796000.)

23842. Babcock & Wilcox, Ltd.—Tubulous heat-exchangers and heat-exchanger tubes. 2nd August, 1956. (796004.)

24494. Union Carbide Corporation, formerly Union Carbide & Carbon Corporation.—Primary electric cell. 10th August, 1956. (795910.)

28419. Leece-Neville Co.—Alternator-rectifier generating system. 17th September, 1956. (796087.)

29101. Electric Furnace Co.—Muffle type furnace with movable sectional furnace shell. 24th September, 1956. (796088.)

29382. Telefunken Ges.—Magnification of a unidirectional voltage. 26th September, 1956. (795915.)

32705. Western Electric Co., Inc.—Cable sheathing apparatus. 26th October, 1956. (796124.)

34673. Naamloze Vennootschap de Bataafsche Petroleum Maatschappij.—Process for the preparation of electrical insulating oils. 13th November, 1956. (796217.)

34739. Varian Associates.—Thermionic tube and method of making same. 30th August, 1954. (Divided out of 796045.) (796046.)

1957

6302. Union Carbide Corporation, formerly Union Carbide & Carbon Corporation.—Electric arc welding gun. 25th February, 1957. (795949.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 7th June:—

TELLUROMETER. No. 761,492. TELLUROMETER (design). No. 761,493. Class 9. Electronic distance measuring equipment and apparatus for using a system of radio waves.—Tellurometer (Proprietary), Ltd., Cape Town, South Africa. Address for service, c/o Joseph Harris & Co., 63, East Walk, East Barnet.

WESTARC. No. 771,075. Class 9. Railway signalling and track control apparatus and parts.—Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, N.1.

No. 769,226 (design). Class 9. Radio apparatus, television apparatus, telecommunication apparatus and instruments; and parts.—Pye Telecommunications, Ltd., Newmarket Road, Cambridge.

No. 773,415 (design). Class 9. Circuit-breakers, switches, distribution boards, switchboards, fitted fuseboards, fuses, contactors, and fuse holders, all being electric; apparatus for use in the distribution of electric power; and apparatus for controlling the speed of motors by current control.—Ottermill Switchgear, Ltd., The Otter Mill, Mill Street, Ottery St. Mary, Devon.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Postmaster-General's Department, Melbourne. 3rd July. Telephones and bell sets. (E.S.B. 12629/58. Ten/32520.)* 2nd October. Multi-channel radio telephone equipment. (E.S.B. 12630/58. Ten/32593.)*

Brisbane City Council. 29th August. Two 275,000 lb/hr boiler units for Tennyson power station. (E.S.B. 12808/58. Ten/32549.)*

Burma.—Burma Purchase Board, Rangoon. 9th June. Electrically driven pumping sets. (E.S.B. 12645/58. Ten/32509.)*

Cheltenham.—23rd June. Corporation. Trunk road lighting equipment. (See this issue.)

Guatemala. — Departmento de Bienes Nacionales, Licitaciones y Asuntos Alemanes, Guatemala City. 11th June. Hydro-electric plant and materials. (E.S.B. 12895/58. Ten/32588.)*

India.—Mysore State Electricity Board, Bangalore. 18th June. 3,000 kVA transformer. (E.S.B. 12748/58. Ten/32511.)* 19th June. Twenty 33 kV group operated switches. (E.S.B. 12749/58. Ten/32512.)*

Iran.—Le Département Général de Construction du Ministère des Voies et Communications, Teheran. 29th June. Electrical conductors, cable and fittings. (E.S.B. 12400/58. Ten/32496.)*

Iranian Sugar Refining Co., Tehran. 13th July. Four 150 kVA diesel generators. (E.S.B. 13204/58. Ten/32550.)*

Malta.—Maltese Government. 31st July. Electro submersible pumping sets for three pumping stations. (See this issue.)

New Zealand.—G.P.O., Wellington. 26th June. Telephone cable gas pressure alarm system. (E.S.B. 12943/58. Ten/32572.)*

Pakistan.—Posts and Telegraphs Department, Karachi. 16th June. Resistances, receivers and transmitters. (E.S.B. 13294/58. Ten/32563.)*

Philippines.—National Power Corporation. 12th June. Transmission line conductors, insulators, etc. (E.S.B. 12973/58. Ten/32582.)*

Salvador.—El Departmento de Proveedura del Instituto de Vivienda Urbana, San Salvador. 16th June. Electrically driven deep well pump. (E.S.B. 13208/58. Ten/32577.)*

South Africa.—Transvaal Provincial Tender Board, Pretoria. 6th June. Five washing machines and five hydro extractors. (E.S.B. 12745/58. Ten/32510.)*

Union Tender and Supplies Board, Pretoria. 12th June. Two electrically driven centrifugal pumps. (E.S.B. 12747/58. Ten/32495.)*

Stores Department, South African Railways, Johannesburg. 13th June. Telegraph line materials. (E.S.B. 12574/58. Ten/32484.)* Switchboards. (E.S.B. 12572/58. Ten/32558.)*

Southend-on-Sea.—9th July. Corporation. Cable for Southend pier. (See this issue.)

Swanage.—U.D.C. 28th June. Street lighting equipment. (See this issue.)

United States.—Bureau of Reclamation, Denver. 12th June. Main control board, load and frequency control equipment and unmounted equipment for Fremont Canyon power plant. (E.S.B. 12810/58. Ten/32540.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Glasgow.—Cleansing Committee. Twenty-two traction batteries (£11,717).—Tudor Accumulator Co.

Hull.—Education Committee. Electric lifts for second instalment of New College of Technology, Queen's Gardens (£32,832).—Hammond & Champness.

Housing Committee. Electrical installation work in 175 houses, Great Field estate (£6,167).—Reliance Electrical Co.

Rothwell.—U.D.C. Supply and erection of 370 sodium discharge street lighting units on reinforced or pre-stressed concrete columns (£11,635).—Concrete Utilities.

Wigan.—R.D.C. Supply and erection of 153 street lamp columns, with fluorescent or sodium lamps and fittings, etc., at Shevington and Wrightington (£4,005).—Loughborough Construction Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ardrossan.—Houses (50), Kirkhall; Scottish Special Housing Association, 15/21, Palmerston Place, Edinburgh, 12.

Bushey.—Houses (100), Heathbourne Road; New Ideal Homesteads, Ltd., South Street, Epsom.

Cambridge.—Erection of new Perse School, Hills Road; R. Matthew & Johnson Marshall, architects, 24, Park Square East, London, N.W.1.

Cardiff.—Houses (76) on sites at Ely North, Fairwater, Llandrumney, Llanishen and Rumney; city architect, 12, Park Place.

Carlisle.—Large factory for Nestlé Co., Ltd., Hayes, Middx.; Hammond J. Harvey, architect, 8/10, King Street, London, W.6.

Cheltenham.—Houses (179), Hesters Way and Malvern Street, maisonnettes and flats (34), Benhall Gardens; borough engineer, Municipal Offices.

Cleethorpes.—Flats (32), Beacon Hill scheme; A. B. Cooper, borough engineer, Council House.

Clydebank.—Houses (100) and shops, Nairn Street area; D. Carr & S. Matthew, architects, 14, Lynedoch Place, Edinburgh.

Colchester.—Occupation centre (£35,575); H. Conolly, county architect, County Hall, Chelmsford.

Corby.—Factory for York Trailer Co.; Robert Marriott, Ltd., builders, Midland Works, Rushden.

Dagenham.—Factory, Hainault estate; Clensol, Ltd., 40, Berkeley Square, London, W.1.

East Ham.—Showrooms and offices, Katherine Road; Basil I. Briggs & Partners, architects, Market Place, Great Dunmow.

Edinburgh.—Houses (119) and six shops, Meadowfield; A. Steele, city architect, City Chambers, High Street.

Edmonton.—Flats and maisonnettes (52), Fore Street redevelopment, and dwellings (72), Provident Park estate; H. Backhouse, town clerk, Town Hall, N.9.

Enfield.—Civic offices; Harding, McDermott & Partners, electrical, heating and ventilating consultants, 18, Doughty Street, London, W.C.1.

Glasgow.—Four- and seven-storey offices, George Street and Balmeno Street; Capital & Counties Property Co., Ltd., 4, Lloyds Avenue, London, E.C.3.

Goring-by-Sea.—C.E. primary school, Mulbery Lane; Hilton & J. M. Wright, architects, 11, Campden Hill Road, London, W.8.

Guildford.—Houses and flats (100), Park Barn site; borough engineer, Municipal Offices, High Street.

London.—Secondary modern school, Kenninghall Road, Clapton (£285,150); J. Jarvis & Son, Ltd., builders, 239, Vauxhall Bridge Road, S.W.1.

Offices for Elliott Bros., Ltd., Conington Road, Lewisham; A. Wright, Ltd., builders, 28, Pound Place, S.E.9.

Works extensions, Muswell Hill; Cambridge Instrument Co., Ltd., Sydney Road, N.10.

Dwellings (48), Laburnum Street, Shoreditch; borough surveyor.

Malden and Coombe.—Maisonnettes, flats and bungalows (50), Woodfield site; J. Apse, borough engineer, Municipal Offices, New Malden, Surrey.

March.—First instalment of new South District Infants' School, Burrowmoor Road; county architect, March, Cambs.

Oldham.—Retail store, Market Place; Littlewoods Mail Order Stores, Ltd., 152a, London Road, Liverpool.

Pershore.—Houses (107); surveyor, Rural Council Offices.

Peterborough.—Additional buildings in Queens Gardens for Deacon's School (£52,448), and extensions to King's School (£38,638); Jellings-Brudenell, Ltd., 174/6, Cromwell Road.

Second stage of Newark Hill Primary School (£54,864); Bernard Stokeley, Ltd., Eastfield Road.

Port Talbot.—Houses (120), Sandfields; borough engineer, Municipal Buildings, Aberavon, Port Talbot.

Reigate.—Flats and maisonnettes (34), Rushetts Farm estate; Pitman Bros., Ltd., Mill Lane, South Merstham.

South Ruislip.—Flats and maisonnettes (36), Station Approach; Davis Estates, Ltd., 346/50, Kilburn High Road, London, N.W.6.

Spalding.—Bungalows for old people, Holbeach Road; W. J. Mumford, 16, Cowbit Road.

Private housing estate development, Marsh Road estate; S. Hale & Son, Ltd., builders.

Old people's bungalows (44); L. A. Gornall, surveyor.

Stamford.—C. of E. school, Empingham Road; Stirton Partners, Ltd., builders, 3, St. Mary's Place.

Stockton-on-Tees.—Houses (200) for industrial workers; R.D.C. surveyor.

Strood.—Houses (160), Hoo; R.D.C. surveyor, Council Offices, Frindsbury Hill, Rochester.

Sunderland.—Houses (38), Hylton Castle estate; Veti, Ltd., builders, Foyle Street.

Sutton Coldfield.—Dwellings (51), Coppice Farm estate; Cooper Estates, Ltd., Wilmington House, Dartford, Kent.

Swindon.—Houses (156), Walcot; John Laing & Son, Ltd., builders, Bunns Lane, London, N.W.7.

Wallsend.—Flats (354); Wimpey & Co., Ltd., contractors, Fenwick Terrace, Newcastle-on-Tyne.

Wing. — Secondary school (£88,483); county architect, County Offices, Walton Street, Aylesbury.

West Hartlepool.—Houses (20), The Grove and Warwick Grove; C. M. Yuill, Ltd., builders, Villiers Street.

Wingate (Co. Durham).—Houses (22), Greenhills estate; R. E. Coleman, Ltd., builders, Western Hill, Durham.

TUDOR

- for your power plant

Tudor Switch-Tripping Equipment is easily maintained and utterly reliable. Apart from use in power plants and unattended sub-stations, it is also suitable for many other applications where the load is intermittent and an unfailing supply is required should a temporary mains interruption occur.

Tudor

Please send for Folder No. 65/ which gives performance details and includes a full specification. Also available on request is Tudor Publication No. 100/, dealing with the complete subject of battery equipment for power and sub-stations.

T 156

SELF-CONTAINED SWITCH-TRIPPING EQUIPMENT

THE TUDOR ACCUMULATOR COMPANY LIMITED, 137 VICTORIA STREET, LONDON SW1. Telephone TATe Gallery 0307
Works: DUKINFIELD, CHESHIRE. Telephone Ashton-under-Lyne 1651

DEMAND UP — PRICE DOWN!

"Lacent" 60/100 watt.
Cat. No. 422B Bulkhead
now 32/-

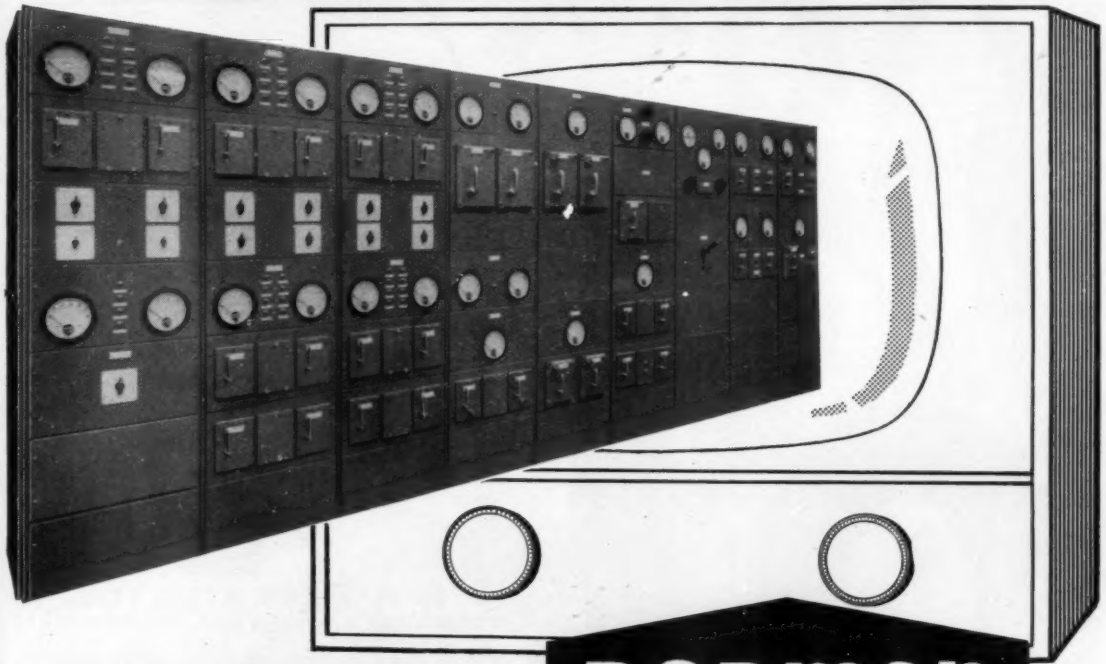
HEYES of Wigan

HEYES & COMPANY LIMITED
WATER-HEYES ELECTRICAL WORKS · WIGAN
•London Office: 11 John Street, W.C.1.

Sales Depots in the United Kingdom:
LONDON: 10, Northington St., W.C.2. Tel: Holborn 4183. SCOTLAND: 158, Bath St., Glasgow, C.2. Tel: Douglas 6459.
IRELAND: 38, Fountain St., Belfast. Tel: 26222. SOUTH WALES: Service House, Hills Terrace, Cardiff. Tel: Cardiff 31461 (3 lines)

dm HC 153

INTRODUCING...



DORMAN

THE PANEL OF EXPERTS

When "The next object" is planning the switchboard, specify Dorman Cubicles with the front operated type 'TS' switches and reduce switchboard lengths by several feet. The cubicles are erected on standard size frames and fitted with switches, dials, meters and indicators etc. to individual requirements.

They are completely flexible and any length of panel can be constructed by this time-and-money saving method.

Get "full marks" with a Dorman switchboard and components. Send for new literature about the DORMAN SYSTEM... the greatest development in switchboard building.

POST THIS COUPON TO-DAY!

DORMAN & SMITH LTD.

MANCHESTER Ordsal Electrical Works, Manc'r 5
Tel: DEAnsgate 8822

LONDON 125 High Holborn, W.C. 1.
Tel: CHAncery 6431

BIRMINGHAM 2/3 Graham St., Birmingham 1.
Tel: CENtral 2009

GLASGOW 249 St. Vincent Street, Glasgow, C.2.
Tel: CENtral 2479

To: Dorman & Smith Ltd.,
Ordsal Electrical Works, Manchester 5

Please send full details of Dorman system switchgear and switchboards.

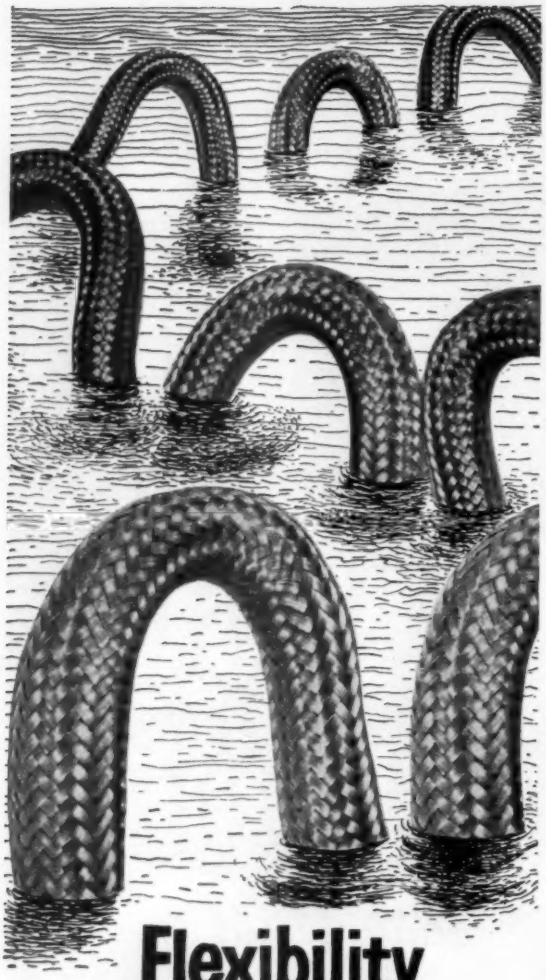
NAME .....

POSITION .....

FIRM .....

.....

ER/5/58

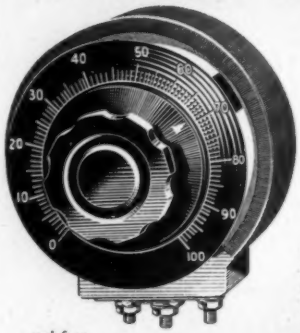


Flexibility

. . . and strength—these are the particular characteristics of Sparklets Wire Braiding. And over 50 years' specialisation in braiding wire for all purposes in a wide range of diameters and widths has taught us most of the answers. If you have a braiding problem, we should be glad to hear about it.

SPARKLETS
wire braiding
SPARKLETS LTD - DEPT. WD - QUEEN ST - TOTTENHAM, N.17

Consult **Birch**
REGISTERED TRADE MARK
for
TOROIDAL RESISTORS



FORMER : Patented ceramic moulding with horizontally opposed copper graphite internal brush movement.
WINDING : Best quality resistance wires to B.S.S. 115.

Write for list No. 130

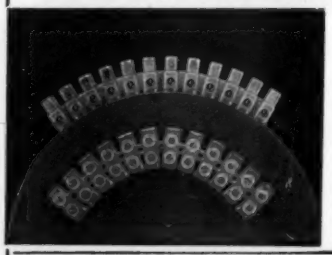
VITREOUS ENAMELLED RESISTORS
Ferrule or wire end type : full range of 24 sizes — 1¼ — 250 watts. List VE. 190.

and for :
Asbestos Woven Mats
Heating Elements
Loading Resistors
Motor Operated Resistors
Stud Type Resistors
Sliding Resistors

Birch
REGISTERED TRADE MARK

H. A. BIRCH & CO. LTD.
WOOD STREET, WILLENHALL, STAFFORDSHIRE
Telephone WILLENHALL 494 · 495 · Grams WILOHM WILLENHALL
LONDON OFFICE : 1-5 NORTHOLT ROAD, HARROW, MIDDLESEX
Tel.: BYRON 5120

12-WAY TERMINAL STRIPS IN FLEXIBLE NYLON



List prices per strip :—

5/10 amp.	4/4d.
15/20 amp.	8/6d.
25/30 amp.	10/8d.

ELKAY ELECTRICAL MFG. CO. LTD.
42 WOBURN PLACE, LONDON, W.C.1 Phone: Langham 1975

COUNT YOUR LUCKY STARS

BUT LET TRUMETER COUNT YOUR PRODUCTION

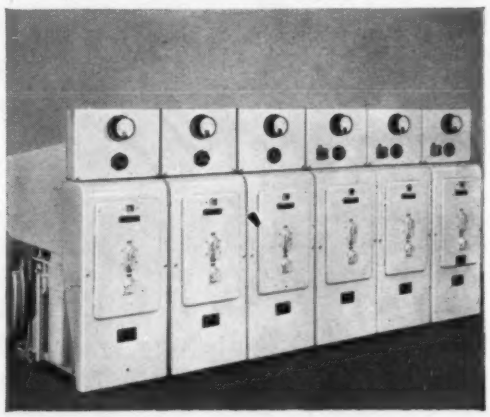
TRUMETER
FOR MEASURING AND COUNTING
TRUMETER CO. LTD., MILLTOWN ST., RADCLIFFE, LANCS.
CW 2642/57

خولش زين

The IRAQIS have a word for Yorkshire Switchgear

...two words, in fact—**kulish zain** (most excellent)

A comprehensive Yorkshire Switchgear installation has been supplied for the Houses of Parliament at Baghdad; it includes a multi panel 11kV—250 MVA switchboard and Ring Main equipment to control power and lighting supplies, speech amplification and air conditioning.
The shade temperature in Baghdad swings annually between 35° and 127°F. Winter humidity is high. The hot summer winds whip up frequent dust-storms which penetrate everywhere.
Essentially, the equipment chosen for the Parliament Buildings must have utter, *proven* dependability under all conditions of climate and supply. Obviously, Yorkshire Switchgear was selected.



YORKSHIRE SWITCHGEAR

& ENGINEERING CO. LTD.,
LEEDS, 6. TEL: LEEDS 87121-6

London: Grand Buildings, Trafalgar Square, W.C.2. Tel: Whitehall 3530
Associated with Electro-Mechanical Manufacturing Co. Ltd., Scarborough

11303

Production WINDING

Coils
Transformers
Armatures
and Stators

Special department
for REWINDS and
REPAIRS
24 HOUR SERVICE
Work collected and
returned

T. A. BOXALL & CO.
20 Balcombe Road
Horley • Surrey
Telephone: Horley 4388/9

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the very latest developments, are described fully in these new leaflets . . .

SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra-modern equipment:

PHOTO-FLASH EQUIPMENT • DEAF AIDS
PRIVATE TELEPHONE INSTALLATIONS
AMPLIFIERS • D.C. POWER UNITS
TRANSISTOR EQUIPMENT
MAGNETISATION EQUIPMENT
TEST GEAR

DALY
ELECTROLYTIC CAPACITORS

Condenser Specialists for over 20 years.

DALY *(Condensers)* **LTD.,** WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5. PHONE: EALING 3127-8-9. CABLES: DALCYON, LONDON

SAFE DEPENDABLE CONTROL

FOR GROUPED MOTOR CONTROL the safe, dependable choice is a CHESTER MAJOR switchboard.

Consider these features—short circuit protection up to 35 MVA; all isolating swing-out or draw-out starting panels; every component tested in excess of BS specifications. Then add—backed by 60 years' experience; fully tooled; short delivery.

In every respect it will pay you to switch to the CHESTER MAJOR.

Illustrated is a CHESTER MAJOR switchboard supplied for controlling the materials handling system in a tin mine in Tanganyika. Extreme accessibility with complete isolation permits safe, simple maintenance by unskilled native labour.

BROOKHIRST

CHESTER MAJOR SWITCHBOARD

BROOKHIRST SWITCHGEAR LIMITED NORTHGATE WORKS CHESTER

cvs-61

a new geared motor

Type DS
smaller
lighter
cheaper

1/6, 1/4, 1/3, and 1/2 H.P. Final speeds from 26 r.p.m. to 475 r.p.m. on all A.C. and D.C. voltages. Ball bearing spur gearbox; motor and final shafts coaxial, with the same dimensions for all speeds and voltages.

NECO TRADE MARK

geared motors

NECO GEARED MOTORS LTD
204 QUEENSTOWN ROAD · LONDON · S.W.8
Telephone: MACaulay 3211-4
Subsidiary of Normand Electrical Company Limited

THREADED PLUGS

A wide range of sizes for Conduit and B.S.P. threads

Litholite Plastic Moulders since 1901

LITHOLITE Insulators & St. Albans MOULDINGS LTD.
Sandown Road, WATFORD, Herts. Tel. WATFORD 4494

THE NEW INDESTRUCTIBLE TEST LAMP

SUPPLIED WITH INTER-CHANGEABLE STEEL PRONGS ANGLED AND STRAIGHT

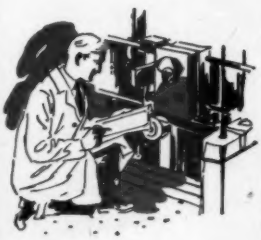
Electrical Engineers will find the new modified Test Lamp indispensable. The interchangeable prongs housed in the carrier band allow the Test Lamp to be used for every purpose and circumstance. The Lamp is housed in moulded rubber with Perspex case. Supplied with 4 ft. of 6 m.m. H.T. cable and H.R.C. fuses in prod.
100-500 Volts. A.C.-D.C.

PRICES
TYPE MTL 3 (illustrated)
35/-
TYPE MTL 1 with fixed prods
30/-
Special Terms to Wholesalers and Large Buyers

JOHN DRUMMOND (ENGINEERS) LTD.
Bellcrag Works, Dalsholm Road, GLASGOW, N.W. Tel.: MARyhill 3315

extrusion and continuous vulcanisation

MEANS HIGH QUALITY RUBBER CABLES



Combined extrusion and vulcanisation is a continuous process perfected by BICC for the manufacture of a wide range of rubber insulated cables.

Copper conductors or insulated cores are passed through an extruder head, where a rubber covering is applied, and then directly into a tube 200 feet long, containing steam at pressures of up to 200 lb./sq. in. On emerging from the tube, the insulation on the wire, or the sheathed cable, is fully vulcanised.

Quality control techniques permit the combination of high standards with high output speeds during this continuous process. Correct dimensions are ensured by using electronic gauges which automatically measure and record during the manufacturing operation.

. . . some of the ways we ensure that BICC Cables will never let you down.

BICC

RUBBER CABLES

Good FOR YEARS OF SERVICE

BRITISH INSULATED CALLENDER'S CABLES LIMITED · 21 Bloomsbury Street · London, W.C.1

F

Stock answer...

By specifying JMC standard headed contacts you can relieve stock problems — for delivery of almost any quantity can normally be made at once. To this, add the advantages of lower cost, sound design and maximum operating efficiency.

The stock answer to many problems of contact selection — and a convincing one — is the adoption of JMC standards.

A series of technical data sheets is free on request.

One of the Specialised Products of

Johnson Matthey

JOHNSON, MATTHEY & CO., LIMITED

73-83 HATTON GARDEN, LONDON, E.C.1. Telephone: Holborn 6989

Vittoria Street, Birmingham, 1. Tel: Central 8004. 75-79 Eyre Street, Sheffield, 1. Tel: 29212

SC1

now available!

THE NEW BKS 88 PAGE electrical control equipment catalogue

This new catalogue gives full technical data, dimensions and prices for the current range of British Klockner Switchgear Electrical Control Equipment.

- ★ Direct-on-line Starters
- ★ Reversing Starters
- ★ Auto Star-Delta Starters
- ★ 2-Speed Motor Starters
- ★ Auto Transformer Starters
- ★ Auto Stator-Rotor Starters
- ★ Contactors
- ★ Thermal Overload Units
- ★ Push Button and Remote Control Stations
- ★ Limit Switches and Rotary Switches

This catalogue will be sent FREE on request.

BRITISH KLOCKNER SWITCHGEAR LTD.

Head Office and Works: **CHERTSEY, SURREY**

Telephone : Chertsey 2067 *Telegrams : Switchgear, Chertsey*

SALES OFFICES

LONDON	Refer to Head Office
MANCHESTER	Cromford House, Cromford Court Tel.: Blackfriars 3903
GLASGOW	249 St. Vincent Street Tel.: Central 2479
NEWCASTLE	4 Beechwood Avenue, Monkseaton, Whitley Bay, Northumberland Tel.: Whitley Bay 24231
BIRMINGHAM	190 Aldridge Road, Streetly, Staffordshire Tel.: Streetly 1641
DUBLIN	11 Crow Street, Dublin Tel.: Dublin 71717

post this coupon TO-DAY

To BRITISH KLOCKNER SWITCHGEAR LTD., CHERTSEY, SURREY

Please send me your latest comprehensive catalogue.

NAME.....

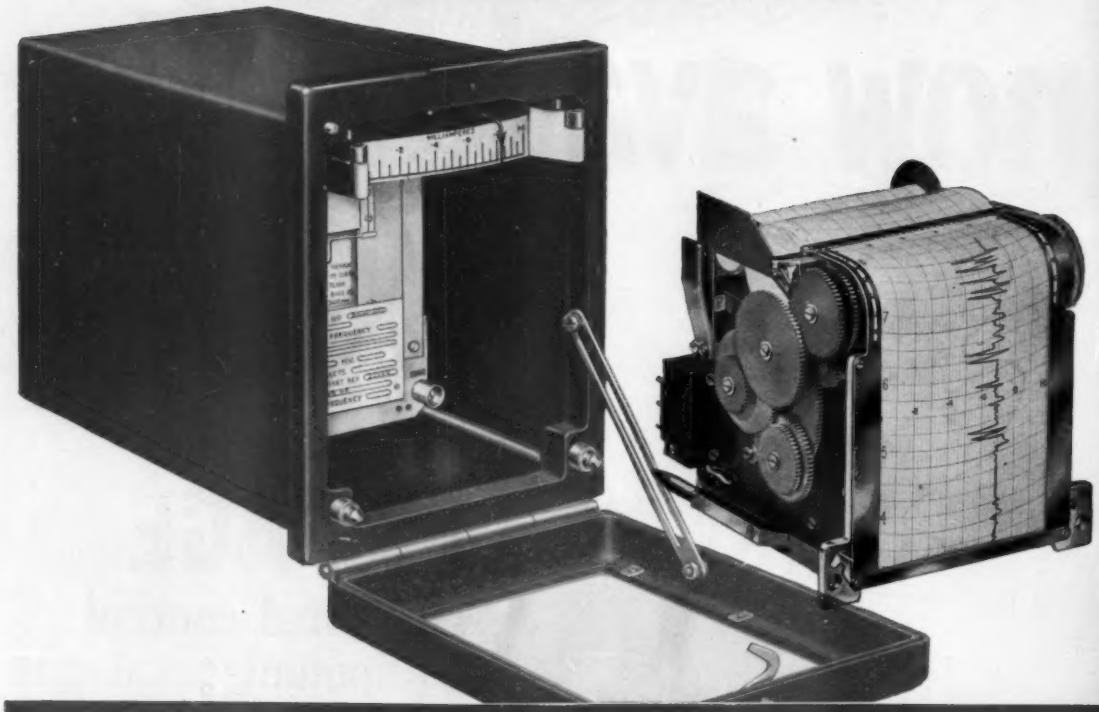
POSITION.....

FIRM.....

ADDRESS.....

ER/5/58.....

Inside story...



RECORD

GRAPHIC RECORDING INSTRUMENTS

are the fastest and most sensitive direct writing Recorders now available.

E.g. 0/100 microamperes, consumption 0·2 milliwatts response time 0·4 second *
0/1·5 milliamperes, consumption 50 milliwatts, response time 0·1 second *

(**To within 2% of indication*)

The secret of this remarkable performance lies in the generously proportioned movement which is designed to utilise every available cubic inch of a case which occupies the minimum of panel space.

A wide selection of other ranges can be quoted according to requirements, including Amperes, Volts, Watts, Vars, Frequency and R.P.M., also multi-range with Clip-on Transformer.

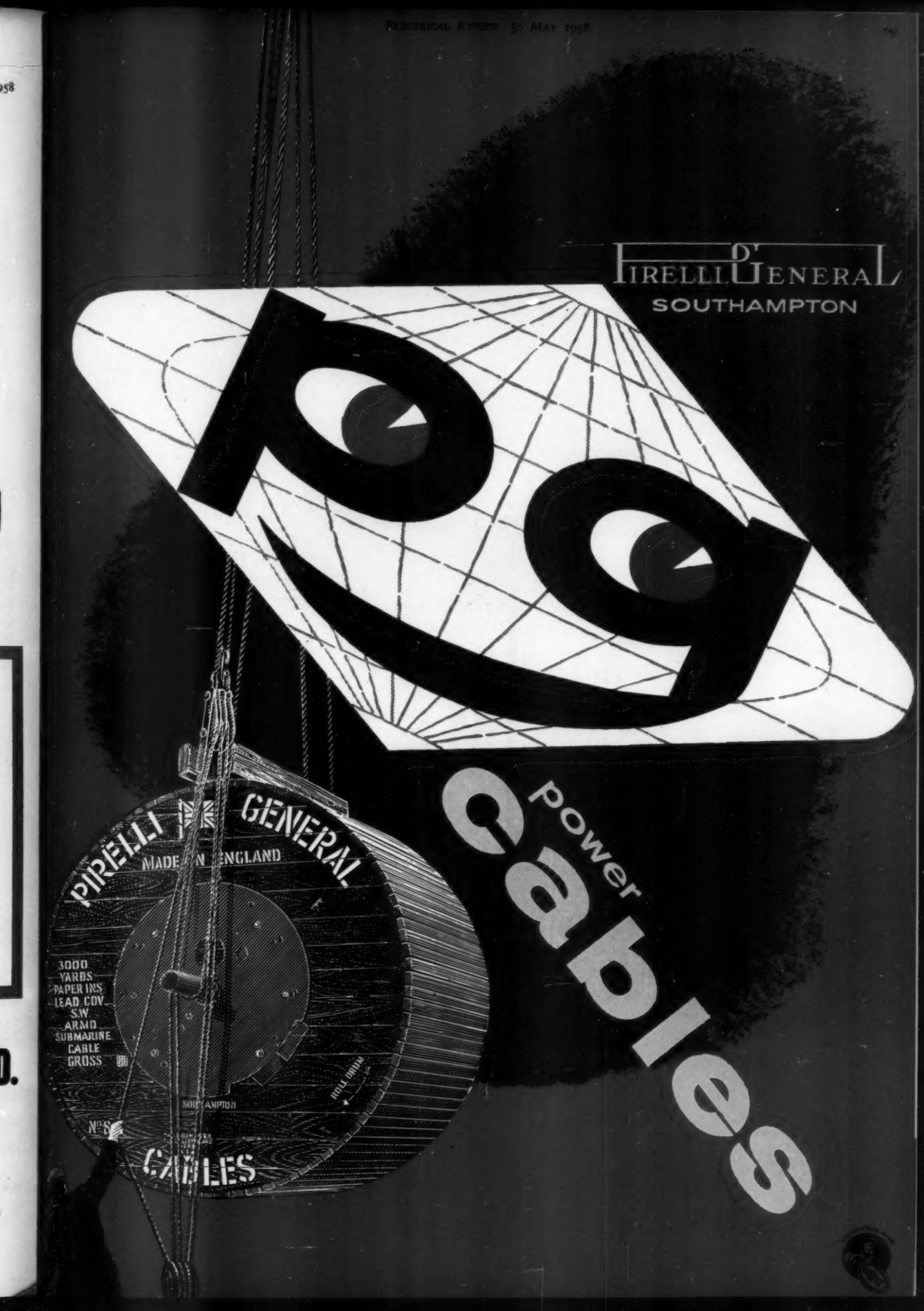
Also manufacturers of "Cirscale" (reg. trade name) Ammeters, Voltmeters, Wattmeters, Frequency Indicators, Power Factor Indicators and Rotary Synchroscopes, Portable Testing Instruments, Protective Relays, "Cirscale" Electric Tachometers, etc.

THE RECORD ELECTRICAL CO. LTD.

"CIRSCALE WORKS," BROADHEATH, ALTRINCHAM
CHESHIRE

Offices at: Belfast, Birmingham, Bristol, Dublin, Glasgow, Leeds, London

C 8651


PIRELLI GENERAL
SOUTHAMPTON
PG
power
cables
PIRELLI GENERAL
MADE IN ENGLAND
3000
YARDS
PAPER INS
LEAD COV
S.W
ARMD
SUBMARINE
CABLE
GROSS
SOUTHAMPTON
HULL DRUM
No 8
CABLES

A New METROVICK Infra Red Oven

The new Metrovick type IRO/2 oven has been specially designed for the heat processing of small articles in batch production; it is especially suitable for pre-heating, paint stoving, drying of lacquer, the removal of moisture from chemicals or foodstuffs, curing and softening of plastics, and the drying and activation of adhesives.

The oven utilises the well proved Metrovick tubular sheathed heating elements, which are mounted in anodised aluminium reflectors. The unit is rated at 6 kW and is suitable for use over the voltage range 400/440V, 3 phase or 230/250V single phase. Please write for further details.

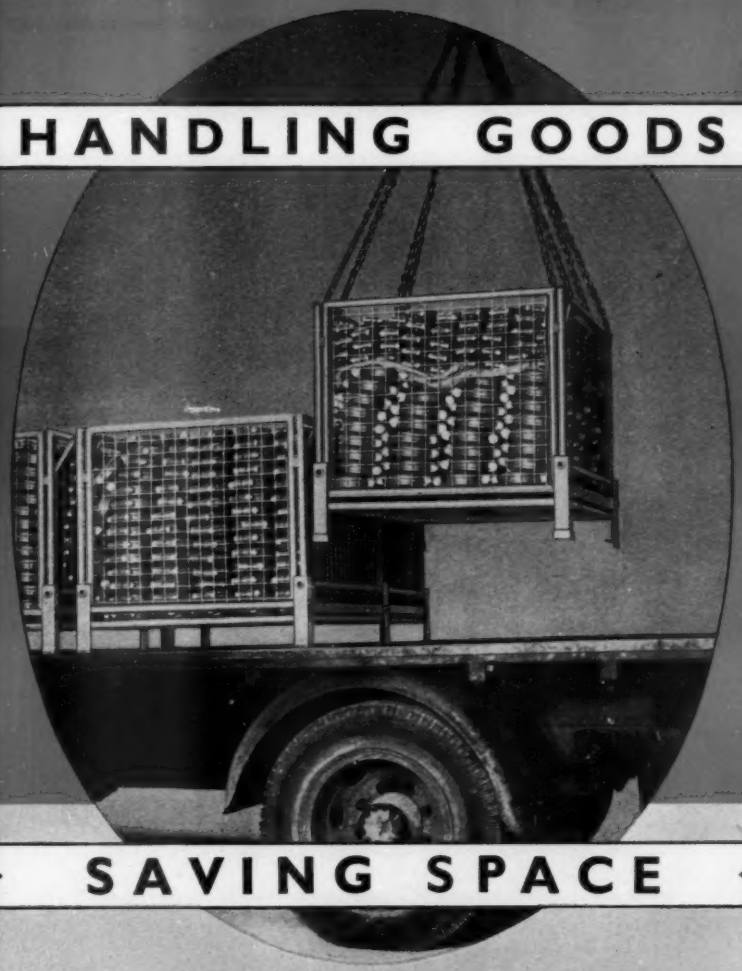
METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

An A.E.I. Company

Leading Industrial Process Heating

L/I 706

HANDLING GOODS



SAVING SPACE

Tubewrights' collapsible tubular steel crates

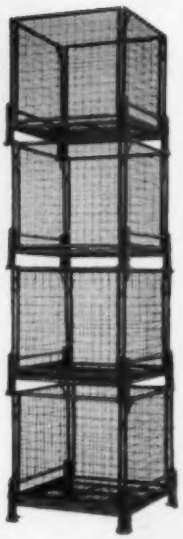
These important space-savers are made in three standard sizes to take 5, 10 or 20 cwt. The illustration above shows them in use for handling heavy steel pipe couplings.

The comparison at the side shows the saving in space when storing empty crates, a saving which is one of many due to the efficiency, ease in handling and long life of Tubewrights' equipment.

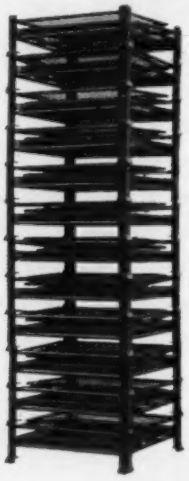
We are constantly adding new designs to meet customers' requirements, and our engineers are always available for discussion.

TUBEWRIGHTS LTD., KIRKBY TRADING ESTATE, LIVERPOOL
Telephone: Simonswood 2882
A SUBSIDIARY OF STEWARTS AND LLOYDS LTD.

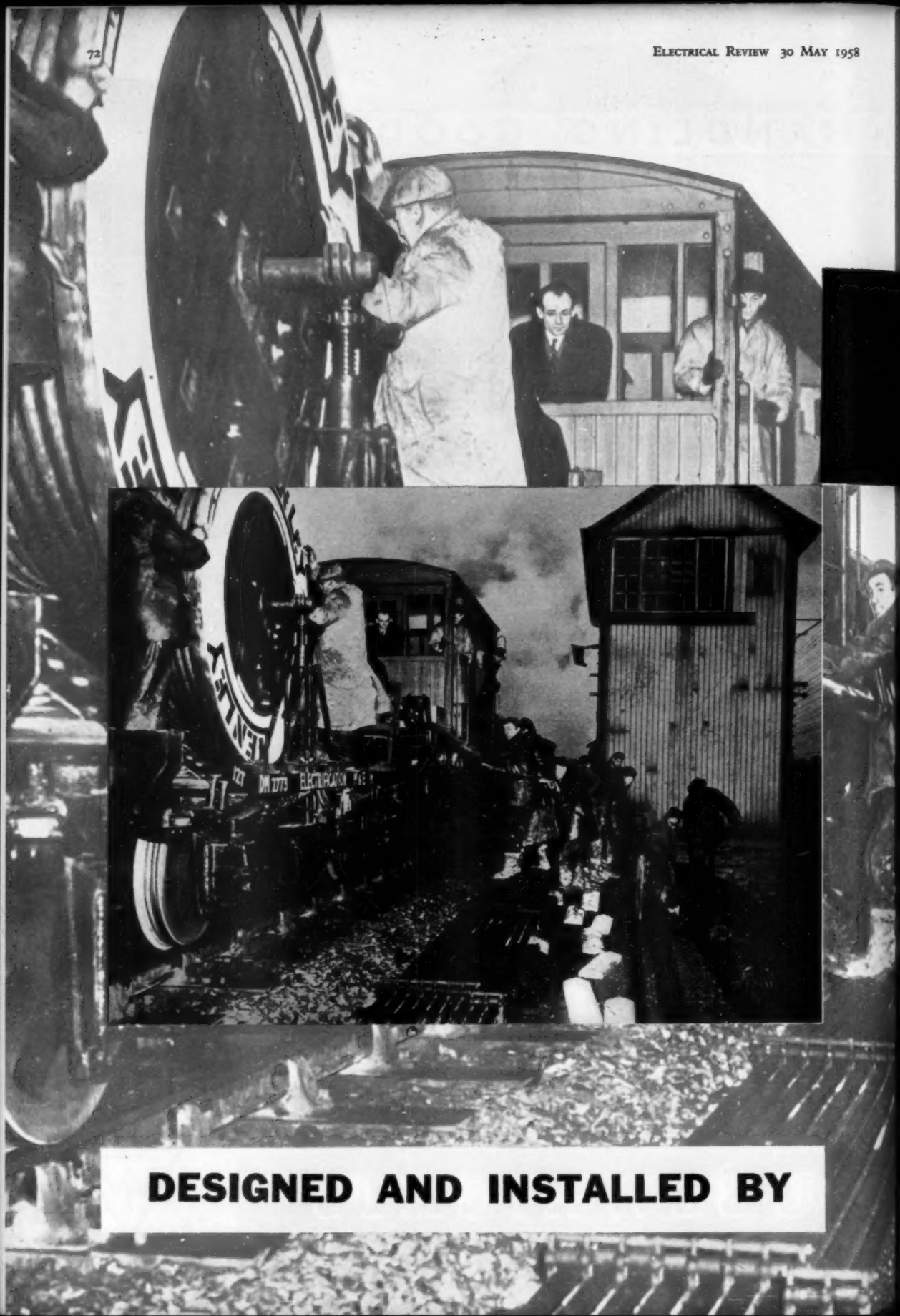
TUBEWRIGHTS



The photographs show, above, 4 of these crates assembled ready for use, and below to the same scale, 12 pallets stacked for storage: these occupy less space than the 4 assembled crates.



REGD. TRADE MARK

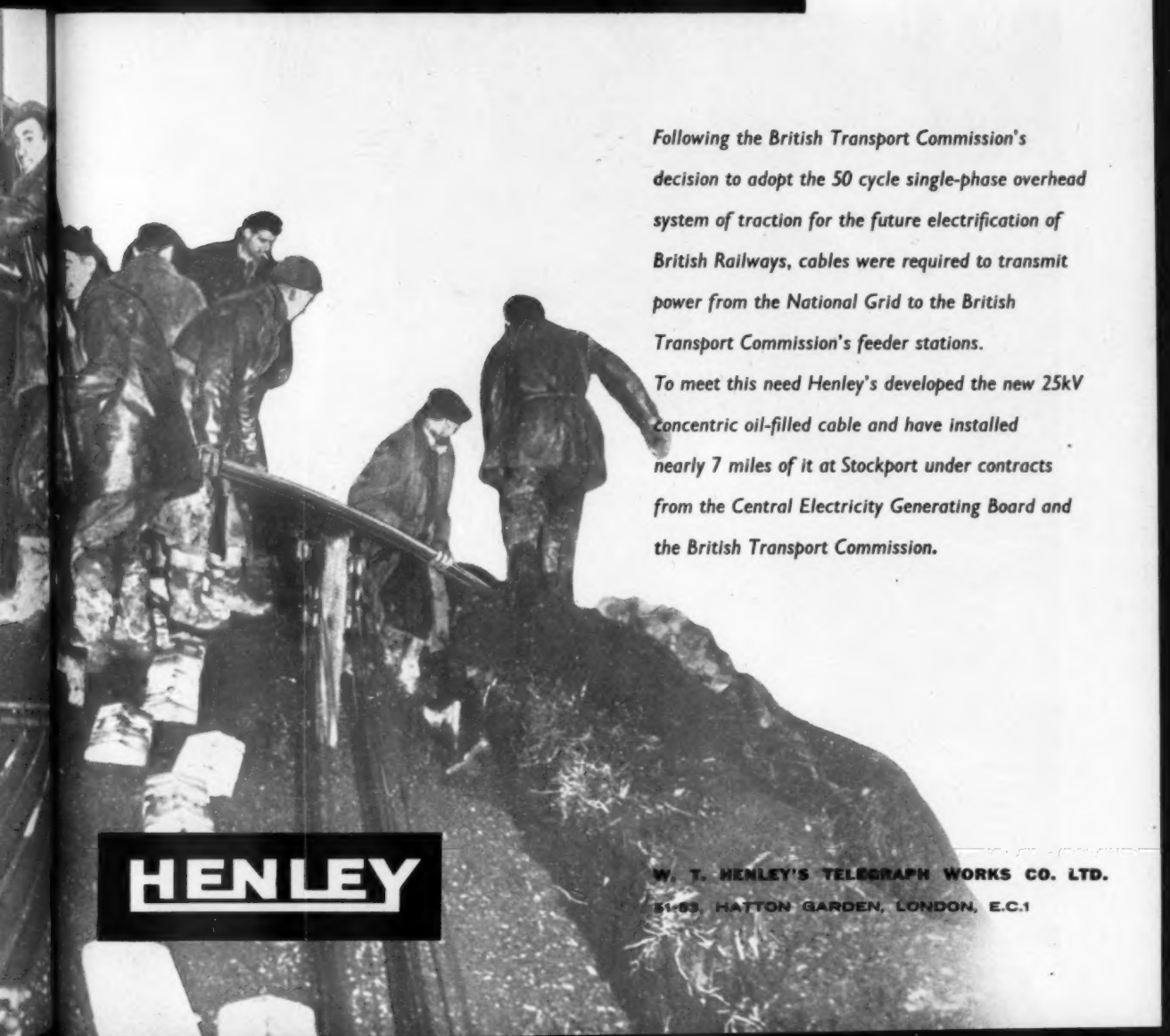


DESIGNED AND INSTALLED BY

By appointment to
H.M. The Queen
Electric Cable Manufacturers

THE FIRST 25kV CONCENTRIC OIL-FILLED CABLE

for railway electrification in Great Britain



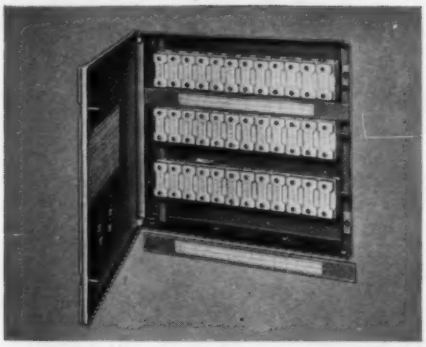
Following the British Transport Commission's decision to adopt the 50 cycle single-phase overhead system of traction for the future electrification of British Railways, cables were required to transmit power from the National Grid to the British Transport Commission's feeder stations.

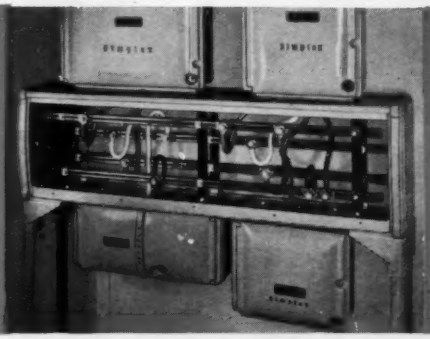
To meet this need Henley's developed the new 25kV concentric oil-filled cable and have installed nearly 7 miles of it at Stockport under contracts from the Central Electricity Generating Board and the British Transport Commission.

HENLEY

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51-53, HATTON GARDEN, LONDON, E.C.1

it's the installed cost that counts!





money down the drain?

FIRST PRICE ISN'T EVERYTHING. With switchgear, poor design can throw your money down the drain on wasted man-hours: it's the *installed* cost that counts!

That's why more and more men in your position are choosing Simplex switchgear. It's good switchgear — and looks it: it's completely dependable: and best of all, it's designed from your point of view — rationally designed for simplicity, economy and versatility in installation and maintenance

cut costs and specify

switch and fuse gear by

Simplex

this man works for you

Simplex have a whole team of practical experts — whose job it is to help you with designing, building and advice on complete Simplex Switchboard installations. Write or telephone the Simplex Switchboard Service

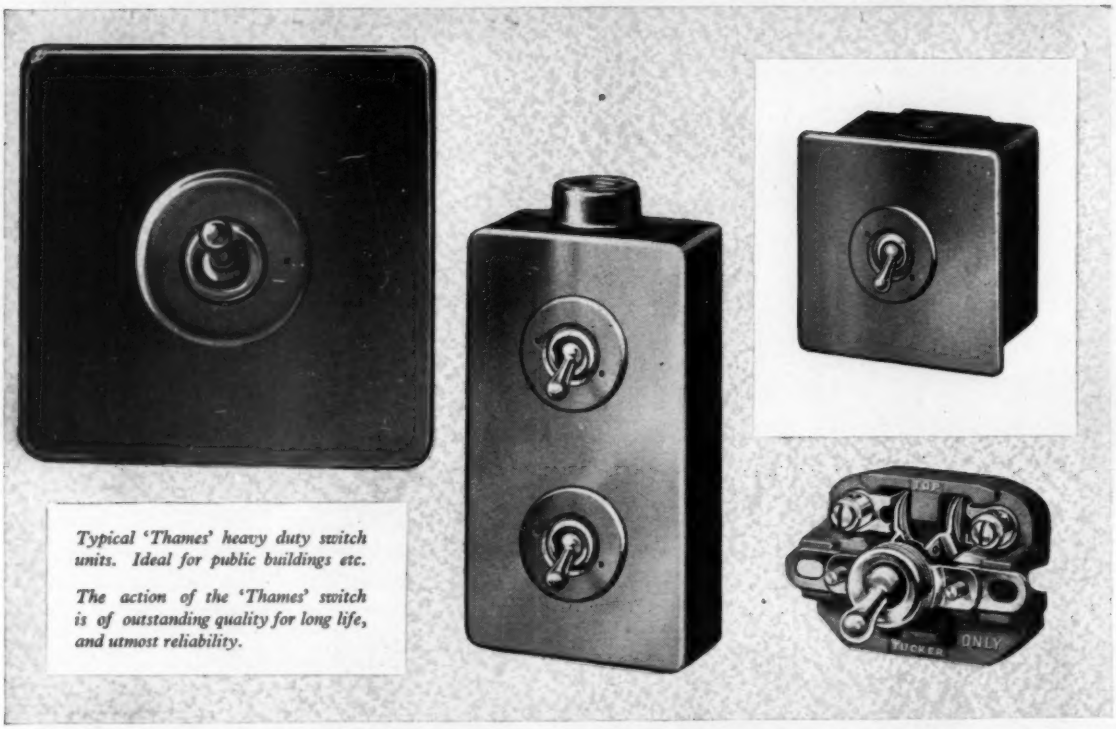
***Write today** for literature to*

Simplex Electric Co Ltd Oldbury Birmingham

Branches throughout Britain and agents throughout the world

A COMPANY

For top quality controllably silent AC switches —the 'THAMES' range



Typical 'Thames' heavy duty switch units. Ideal for public buildings etc.

The action of the 'Thames' switch is of outstanding quality for long life, and utmost reliability.

THE 'THAMES' RANGE is a series of superlative quality flush AC switches and flush and surface switch assemblies. They are designed for heavy duty and are controllably silent in operation and enduring in service.

A valuable feature is the large flange locking ring which can be locked as a protection against unauthorised removal or tampering.

The 'Thames' range is ideal for schools, hospitals and other public buildings. One and two-way types are available, 5 amps, 250 volts.

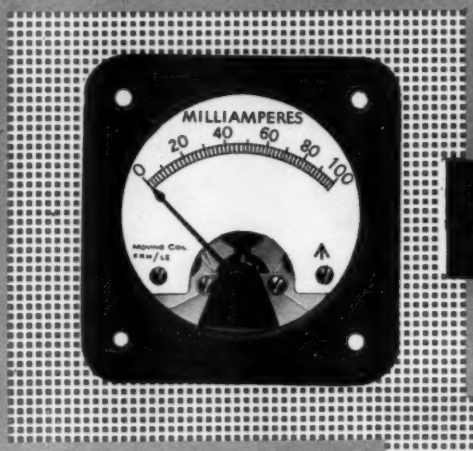
Send for your copy of the MEM-Tucker-Kerson catalogue—Britain's most complete accessories list.

Tucker TELAC MEM KERSON

MIDLAND ELECTRIC MANUFACTURING CO. LTD., ACCESSORIES DIVISION, REDDINGS LANE, TYSELEY, BIRMINGHAM 11.

FERRANTI SEALED INSTRUMENTS

COMPLY WITH RCS 231 AND RCL 231



2" SEALED INSTRUMENT
TYPE APPROVED

2½" AND 3½"
SEALED INSTRUMENT

Ferranti sealed instruments comply with the requirements of the Joint Service Radio Components Standardisation Committee.
Full Type Approval has been obtained for 2" instruments, Humidity Class H.1 and Temperature Category 40/85.

F
FERRANTI

FERRANTI LTD · MOSTON · MANCHESTER 10
London Office: KERN HOUSE · 36 KINGSWAY · W.C.2

F1163/2

did you know that there are now more than 600 Spire Speed Fastenings

Isn't it just possible that some of our latest developments are new to you? Just possible that one of them might be the way around an awkward—or expensive—assembly job? Give us the chance to examine your products and suggest where you could be saving time and money on your assembly lines. Call in our technical representative—he's a fastening expert.

Spire

SIMMONDS AEROCESSORIES LIMITED
SPIRE SPEED NUT DIVISION,
11A, ALBEMARLE STREET, LONDON, W.1.
Tel: HYDe Park 5741/2.

Head Office & Works: Treforest, Pontypridd, Glamorgan.
Branches: Birmingham, Manchester, Glasgow, Stockholm, Copenhagen, Ballarat, Sydney, Johannesburg, Amsterdam, Milan and New York.

A MEMBER OF THE FIFTH CLEVELAND GROUP

CRC 535

Ashley REGD 13 AMP. RING CIRCUIT

Guaranteed ACCESSORIES

MPG 23 SOCKET ADAPTOR
Complies I.E.E. 611(a). Brown or Cream.
Safety shuttered twin outlets.
B.S. 1362 13 Amp. Cartridge Fuse-Link.

SOCKETS & SWITCHSOCKETS
B.S. 1363 & 2814
Brown or Cream. Flush, for plaster depth or deep socketboxes. Surface, with optional backplate I.E.E. 207 G. Safety shuttered. Quiet switch, silver contacts, nylon pad.

SS 35

SK 31

SELECTIVE ENTRY SPUR BOX (Pat.) B.S. 816
3½" dia. x 1½" x 2" fixing centres. Four cable entries, those unused closed by shutters integral with cover. Three block terminals each taking up to four 7/.029 conductors.

FUSED PLUG B.S. 1363. Brown or Cream. Block terminals. B.S. 1362 Cartridge Fuse-Link, 13 Amp. supplied, 10, 5 or 2 Amp. also available. Optional, High Impact resistant type, Black.

PG 13

J 401

Literature and technical service, with pleasure.

Ashley REGD

ASHLEY ACCESSORIES LIMITED, ULVERSTON, LANCASHIRE
Telephone: Ulverston 3333 *Telegrams:* Ashley, Ulverston
MEMBER OF THE ASHLEY GROUP

AT 103

ALL-ELECTRIC HOUSES ARE HERE

ABOVE: These are some of the All-Electric Houses on an estate under development at Woking.

LEFT: The Ferranti Fridge-Heater provides constant hot water and a refrigerated larder.

BELOW: Ferranti Panel Fires provide an attractive focal point-of-interest.

They cost less to build less to sell & less to run

These are houses of the future. They will be up-to-date in 1980. Why? Take a look at the roofs—there are no chimneys. These are all-electric houses on an estate which is being developed in Woking. They have a domestic heat pump installed for providing constant hot water and a refrigerated larder. Central heating is provided either by built-in convector heaters or by heating cables buried in solid floors. This latter type of heating gives an evenly spread heat throughout the house and the power may be taken at night when special off-peak rates are available. The absence of chimney breasts and flues means no more draughts and additional space.

The latest types of insulating materials are used in the construction of these houses, for example, lightweight concrete blocks are used for the inner walls and insulation round the edges of the floors prevent loss of heat through the walls. Roof insulation is also provided which cuts down one of the greatest sources of heat loss in any house. And the cost? The capital and running costs are actually less for this type of house than for a conventional one. The all-electric house is here to stay. Look at the tables below; the savings shown are taken from actual figures in the all-electric houses at Woking.

CAPITAL COSTS

All-Electric House	£	s.	d.
Fridge-heater	139	12	7
Floor warming cable installation	90	0	0
Living room, radiant fire	18	17	8
Bathroom, radiant fire	5	5	0
Bedroom, radiant fires (three)	20	15	3
Extra wiring and labour	15	0	0
	£309	10	6

Conventional House	£	s.	d.
Refrigerator, 4 cu. ft ...	80	0	0
Two chimneys and coal bunker	136	0	0
Flashing, chimney soakers	10	0	0
Tiler and carpenter ...	7	0	0
Ducts in floor	1	10	0
Slow burning grate and surround	50	0	0
Five radiators and valves	21	5	0
Towel rail	10	0	0
Boiler and pipes ...	50	0	0
Tubing and plumber's labour	70	0	0
Decorators	3	0	0
	£438	15	0

SAVING BY ELECTRIC METHOD £129 4 6

Average total running costs for a 3-bedroomed house (water heating, space heating, lighting, cooking and accessories) average between £50-£60 p.a.

The All-Electric House

features the Ferranti Fridge-Heater and also Electric Central Heating

FERRANTI

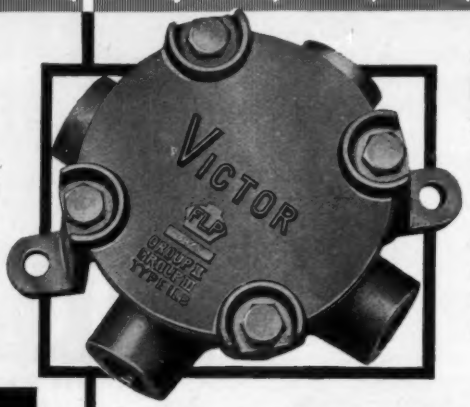
Write for details to:

Ferranti Ltd., Domestic Appliance Dept., Moston, Manchester 10

Weatherproof and Flameproof

LIGHTING EQUIPMENT

For exposed positions, VICTOR offer a comprehensive range of fully weatherproof-flameproof lighting fittings. By separating F.L.P. and weatherproof joints, a completely hermetically-sealed unit is achieved. Available in several designs to suit virtually every position.



JUNCTION BOXES

In the junction box range, similarly independent F.L.P-Weatherproof paths are provided in these, the first fully weatherproofed boxes in the field.

Victor

VICTOR PRODUCTS (WALLSEND) LTD.
Wallsend-on-Tyne, England.
Tel : Wallsend 68331 (6 lines) 'Grams' "VICTOR" Wallsend.
London Office: 26, Millbank, S.W.1. *Tel: TATe Gallery 0033.*

We specialise in

FHP Motors

Including Universal, Permanent Capacitor, Induction, Synchronous, Shaded Pole and Split Phase types. These motors are also available with Single or Double Reduction Worm Gear Boxes, with a range of speeds from ¼ r.p.m. up to 840 r.p.m.

Our latest catalogue available on request.

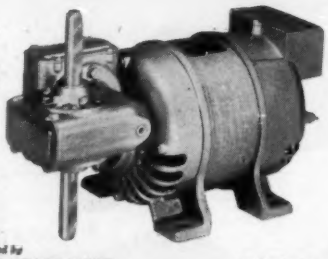


Illustration shows Parvalux S.D.20 Double Reduction Worm Gear Unit with Split Phase Induction motor. 1/8 h.p. with a range of final speeds from 0.2 to 19 r.p.m.

Designed and Manufactured by
REGD. TRADE MARK
PARVALUX
LIMITED
PARKSTONE · POOLE · DORSET · ENGLAND

Telephone: Parkstone 3827 PBX
Telegrams: Parvalux, Parkstone

G

Insist on

T.E.C.

Power and Distribution Transformers to 100 kVA, Low Voltage Flash Test and Rectifier Units, Metal Work, Light Assembly, Slotted Angles and Electrical Repairs.

DISTRIBUTION TYPES
UP TO 100 K.V.A. 11 K.V.

Leaflets on request:—

The TRANSFORMER & ELECTRICAL CO. LTD.
HONYWOOD RD., BASILDON, ESSEX
Telephone: Basildon 20491/3

Illustration shows a 58 cell "TUNGSTONE" Battery — Enclosed Type 25G17S — 200 a.h. capacity.

TUNGSTONE BATTERIES have been designed to meet Post Office and British Standard Specifications. They are being used in Power Stations and Telephone Exchanges all over the British Isles, Australia, India, New Zealand, South Africa, West Indies, Portugal, Venezuela, etc.

TUNGSTONE

BATTERIES

TUNGSTONE PRODUCTS LTD., SALISBURY SQUARE, LONDON, E.C.4. *Telephone:* FLEet Street 8011
Works: MARKET HARBOROUGH, LEICS.

tc15a

USE

MONMER

GREY IRON CASTINGS

for speedy and economical production

Send us your enquiries

MONMER FOUNDRY LTD.

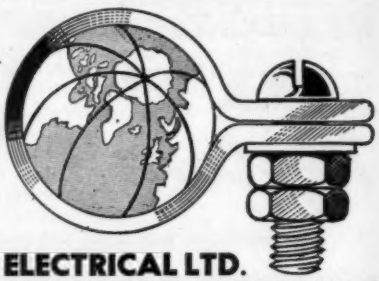
ST. ANNES ROAD, WILLENHALL, STAFFS

Telephone: Willenhall 62

THE

GOOD EARTH

BY



F. RYMAN ELECTRICAL LTD.

72 HUNTERS VALE, HOCKLEY, BIRMINGHAM 19

Phone: NOR 2403

MANUFACTURERS OF EARTHING CLIPS (ALL TYPES) CABLE SOCKETS, COPPER CLAMP WASHERS

QUALITY PRODUCTS ONLY

SAX

Electrical Products

1. Ironclad Bells, Low and High Voltage, a.c. and d.c.
2. Luminous call systems relays, indicators, etc.
3. Bakelite Case Bells and Buzzers, Low and High Voltage, a.c. and d.c.
4. Underdome Type Bells for Ambulance, Factory and Fire Tenders.
5. Bell Transformers, Metal cased, 5-500 watt.
6. Multi-way Domed Glass Luminous Indicator.

Catalogue sent on request

JULIUS SAX & CO. LTD. **24 COMMERCE ROAD** *Telephone:* EALing 6034-5 **BRENTFORD, MIDDX.**

Volex Control Units and Isolating Switches

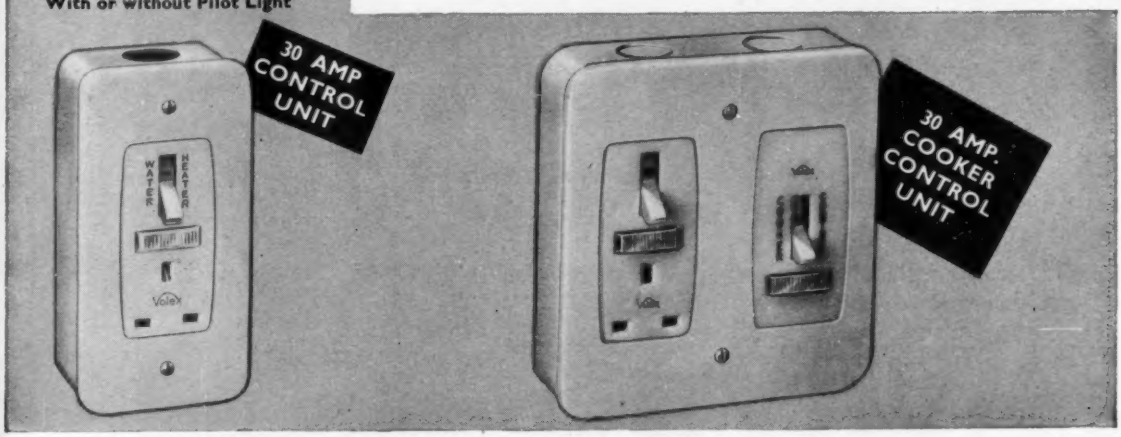
INSULATED COVER
With or without Pilot Light

METAL CLAD
With or without Pilot Light

It is impossible to detail here the vast range of these extremely adaptable 30 amp. D.P. Isolating Switches and Control Units. We therefore invite you to send for our illustrated leaflet giving full particulars of complete range and prices.

Insulated cover types are available in Cream or Brown finish and metal clad types, either flush or surface mounting in attractive Cream stove enamel finish with optional alternatives of satin chrome plates.

Available from your usual wholesale suppliers.



METAL CLAD
With 13 amp. 3 pin Sub-circuit.
With or without Pilot Light.

METAL CLAD
With 13 amp. 3 pin Switched Socket Outlet.
With or without Pilot Light.

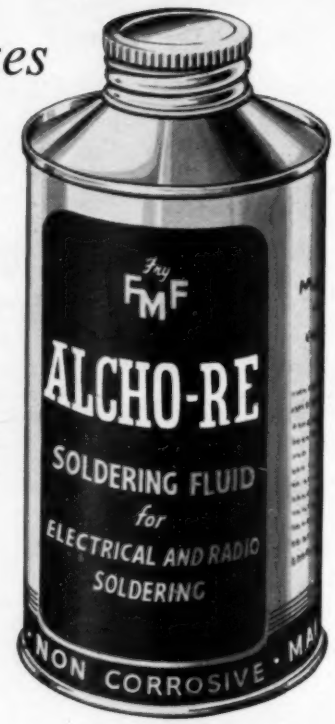
VOLEX ELECTRICAL PRODUCTS LTD.
SALFORD 6

Telephone : PENDLETON 4373 Telegrams : VOLEXPROD. Salford 6

for all electrical soldering . . . . .

ELIMINATE CORROSION RISK

with FRY'S
ALCHO-RE *fluxes*



Supplied in paste, fluid or solder cream form, FRY'S Alcho-Re fluxes completely eliminate all danger of corrosion after soldering.

They conform to specification DTD 599 and are C.I.A. and A.I.D. approved.

Please write for full details, working samples and prices.

FRY'S Metal Foundries Limited

Tandem Works - Merton Abbey - London - S.W.19
Telephone : MITcham 4023
And at: MANCHESTER - GLASGOW - BRISTOL - DUBLIN
MRP 84

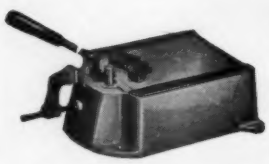
HYDE FOOT-OPERATED WIRE STRIPPER

Strips a wide range of insulated wires and small flexible cables up to ¼" outside diameter. Operating in one quick, effortless action, the stripper will not nick or damage wires.

HYDE E-Z WIRE STRIPPER

Used by hundreds of manufacturers, contractors and service agents. Precision stripping with the E-Z saves Wasting wire, prevents nicking and protects the user's fingers.

Stripping without teasing



HYDE BENCH-TYPE CABLE STRIPPER

Strips insulation from cables up to ¼" outside diameter, no splaying, no nicking, and one single movement does the whole job quickly and cleanly.

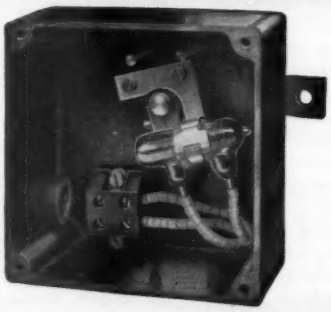
The days of clumsy stripping with knife or pliers have gone—the efficient, modern method is to use HYDE wire and cable strippers. Adjustable stops control length of strip. For greater production and perfect results without skill or experience, HYDE strippers are essential.

Obtainable from all good Tool Dealers or directly from the makers:

J. B. HYDE & CO. LTD.
Dale Street, Broadheath
ALTRINCHAM, CHESHIRE
Telephone: Altrincham 0842
Telegrams: "Braiding, Altrincham"

MERCURY SWITCHES
★
MERCURY SWITCH UNITS
★
MERCURY SWITCH RELAYS
★

1958 CATALOGUE SENT ON REQUEST



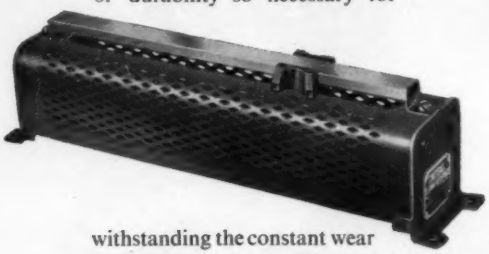
I.A.C. LTD.

Ref. ER, 10 CHASE ROAD LONDON, N.W.10

Can you say sliders six times swiftly?

It's a mouthful—particularly if you add Slider Rheostats for good measure. Fortunately you only have to say it once, preceded by the name **Cressall.**

Cressall Slider Rheostats are built to the very highest possible standard and a very wide range is manufactured, adaptable, where necessary, to individual requirements. Forty years' experience in design and manufacture are behind each **Cressall** Slider Rheostat, which has that extra margin of durability so necessary for



withstanding the constant wear and hard usage in educational and industrial laboratories.

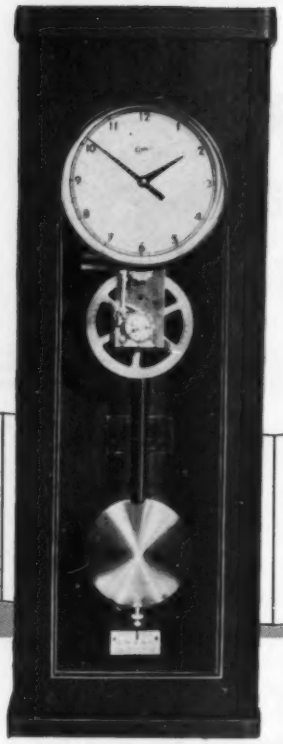
Write for Catalogue Section C List 71.

Cressall

A. I. D. AND A.R.B. APPROVED

THE CRESSALL MANUFACTURING COMPANY LIMITED
(A subsidiary of The Expanded Metal Co. Ltd.)

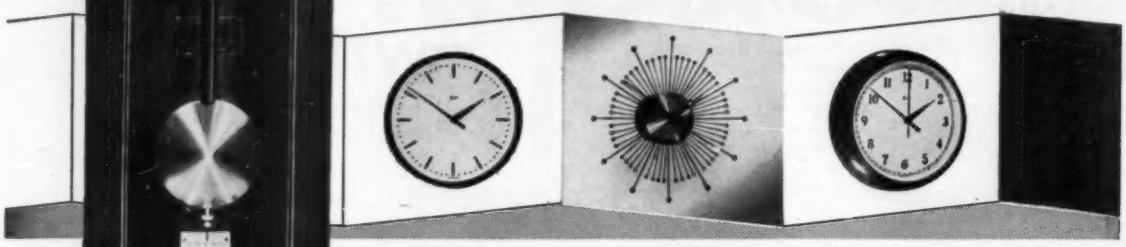
ECLIPSE WORKS · TOWER STREET · BIRMINGHAM 19 · Tel: Aston Cross 2666
LONDON OFFICE: BURWOOD HOUSE · CAXTON ST · S.W.1 · Tel: ABBey 7766



Accurate time-all the time

Many of the newest buildings in Britain are equipped with Gibson Clocks. They are architecturally pleasing and essential to the smooth running of factories, hospitals, schools—indeed wherever accurate time-recording is necessary. Gibson Clocks are available either as individual clocks for one or two offices (worked by small self-contained battery-wound movements) or, for larger installations, on an impulse system in which one 'Master' clock controls any number of 'Slave' clocks. This method is accurate and is not affected by power failures. Time Recording, Job Costing and Sound Signal Systems can be incorporated in these installations. The available designs are varied and good: special designs can be carried out if required.

Clock systems are obtainable on a rental basis or may be purchased outright.



Time Recording, Job Costing and Sound Signal Systems can be incorporated in these installations.

Gibson CLOCKS are made by **BAUME & CO. LTD**
Clock Division, 14A St. Cross Street
London, E.C.1. CHAncery 6187

"Spencers solve our fabrication problems!"

Spencers welcome your enquiries and their advice on any metal fabrication problem is yours for the asking.

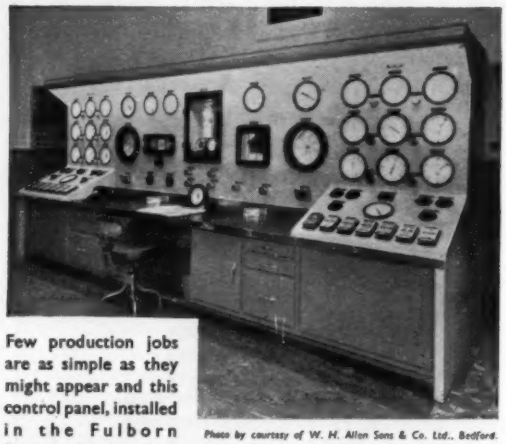


Photo by courtesy of W. H. Allen Sons & Co. Ltd., Bedford.

Few production jobs are as simple as they might appear and this control panel, installed in the Fulborn Pumping Station of the Cambridge University and Town Waterworks Company was no exception, with the high standards of precision and finish demanded in metal fabrication.

Through the wide experience of many years, Spencers offer a specialized individual service in the accurate production of Designers' work and in solving many production problems.

SPENCER & SONS
(MARKET HARBOROUGH) LTD.
Fabrications in Steel and light Alloys

SPENCER & SONS (Market Harborough) LTD. · GREAT BOWDEN ROAD · MARKET HARBOROUGH · TELEPHONE 2651/2

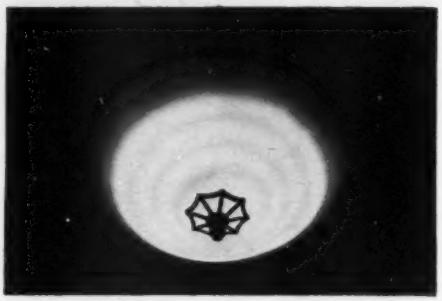
'Perspex' lighting fittings in Swan and Edgar's manufactured by G.E.C.

As good as new after eight years use

Lighting fittings made from 'Perspex' were fitted in Swan and Edgar's Piccadilly store in 1949. Today after 8 years use they are as decorative and efficient as when they were first installed.

'Perspex' lighting fittings combine attractive appearance with durability throughout a very long life. This tough, light, material is unaffected by atmospheric changes and does not age. Its strength minimises risk of breakage during cleaning and maintenance is simplified.

'Perspex' acrylic sheet is easy to shape to attractive modern designs and is available in many grades having suitable optical characteristics.



'Perspex' acrylic sheet is suitable for many varied uses in interior decoration and display and modern designers are making increasing use of this versatile material.

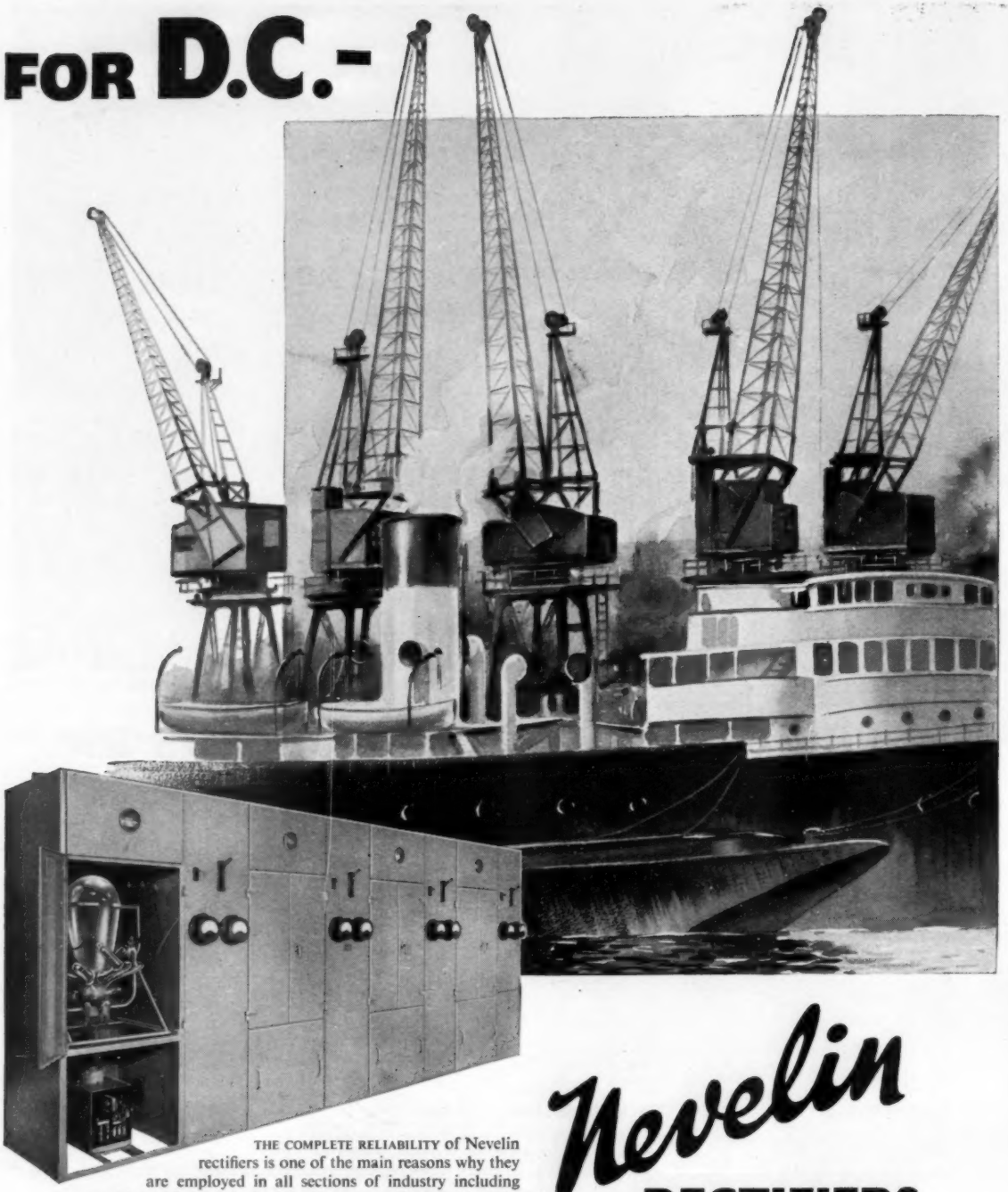
'PERSPEX' **TODAY—FOR TOMORROW**

'Perspex' is the registered trade mark for the acrylic sheet made by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

FP.56

FOR D.C.-



THE COMPLETE RELIABILITY of Nevelin rectifiers is one of the main reasons why they are employed in all sections of industry including ports, docks and harbours and even on board ship. The Lancashire Dynamo Nevelin range of rectifier equipment includes a wide range of standard sets, specially designed installations, and "Varionic" and "Varimag" adjustable speed drives. Whenever you have a problem concerning D.C. power—it pays to consult Lancashire Dynamo Nevelin.

Nevelin

RECTIFIERS

SINGLE OR MULTI-ANODE

Technical information and advice available on request.

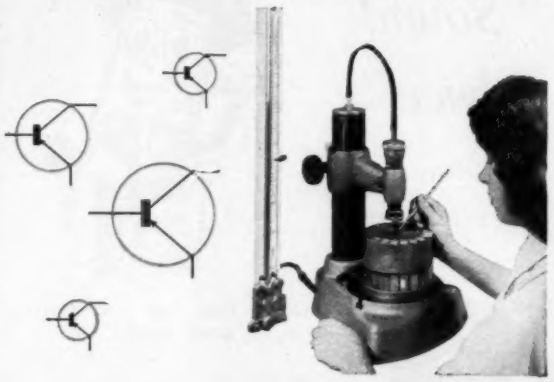
LANCASHIRE DYNAMO NEVELIN LTD

(RECTIFIER DIVISION)

HURST GREEN, OXTED, SURREY **TELEPHONE: OXTED 3361** **TELEGRAMS: NEVELIN, OXTED**

NR8

creating the right atmosphere No. 2

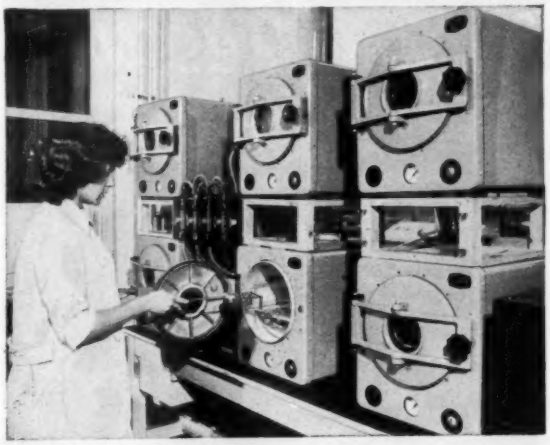


transistor manufacture

In the manufacture of transistors, Siemens Edison Swan Limited use a Birlec direct dehumidifier to maintain dry, dust-free conditions for the preparation and final assembly of germanium wafers. Maintaining 10% relative humidity conditions, the direct dehumidifier ensures accurate grading of the wafers according to thickness, and perfect electrical contact between the wafers forming emitter, base, and collector in the transistor.

Above: Grading germanium wafers prior to assembling into transistors

Below: Drying germanium wafers in vacuum ovens



DRYER DIVISION OF

BIRLEC LIMITED

AN A.E.I. COMPANY

ERDINGTON · BIRMINGHAM · 24

BIRLEC DIRECT DEHUMIDIFIERS FOR AIR CONDITIONING

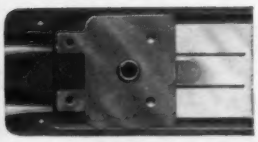
LONDON · SHEFFIELD · GLASGOW · NEWCASTLE-ON-TYNE

SM/B3146/D/AC

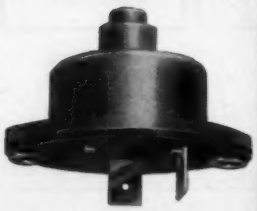
Otter Tubestat

for

safety's



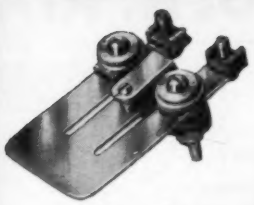
Otter Thermal safety cut-out for Electric Blankets



Otter Motorguard

sake

fit



Type K 20 amp. safety cut-out

Otter

THERMOSTATS

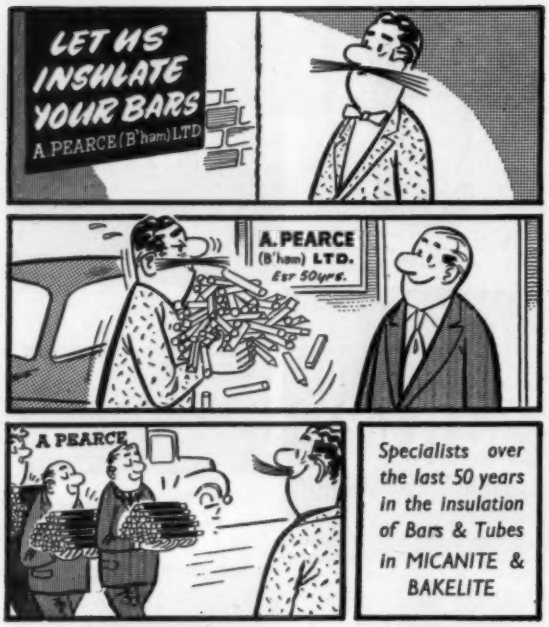
The SIMPLEST and most RELIABLE of all safety switches.

Otters press their contacts together to open them with a 'SNAP'

OTTER CONTROLS LTD.

Otters 'ole, Market Street, Buxton, Derbyshire

Phone: Buxton 650 (2 lines)


LET US INSULATE YOUR BARS
A. PEARCE (B'ham) LTD
A. PEARCE (B'ham) LTD. Est 50yrs.
A PEARCE
Specialists over the last 50 years in the insulation of Bars & Tubes in MICANITE & BAKELITE

A. PEARCE (BIRMINGHAM) **LTD.**

MORCOM ROAD WORKS • GREET
BIRMINGHAM 11

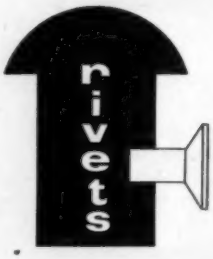
ON ADMIRALTY LIST *PHONE : ACOCKS GREEN 0102*

"Sound Advice"

Says

RIVVY CLEVEDON

"On a busy line you need a good head."



in aluminium brass copper, nickel and all light alloys.

TELEPHONE SUTTON COLDFIELD 5238-9

CLEVEDON

RIVETS & TOOLS LTD

REDDICAP TRADING ESTATE SUTTON COLDFIELD WARKS.

G. A. RIX

KEIGHLEY • ENGLAND

Telephone 2420

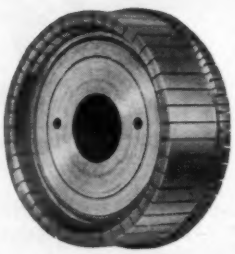
Telegrams: Rix, Keighley

COMMUTATORS

Commutators of all sizes, built to Manufacturers' specifications in large or small quantities.

Other Specialities include

Rebuilding large commutators
Rewinds • Coils
Armatures

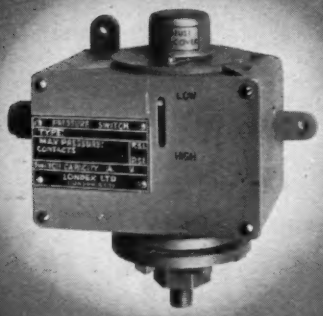


for

Motors, Generators and Auto-Electrical Equipment

LONDEX *Pressure Switches*

FOR ALARM CIRCUITS



LONDEX LTD **LIST ON REQUEST**

ANERLEY WORKS, LONDON, S.E.20 ★Sydenham 6258

NICHROME

Specialists in nickel-containing alloys

NICHROME

BRITISH DRIVER-HARRIS CO LTD

MANCHESTER 15

Indicating r.p.m. of electric motor.

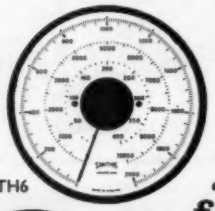
Indicating shaft speed, showing use of extension.

Indicating surface speed.

The Right REVS

Run your machinery at the optimum speed for peak efficiency. Any deviation from this speed almost certainly means that it—and you!—are running at a loss.

Cut this loss by making spot checks of r.p.m. with a SMITHS Hand Tachometer. Such a check can be made in an instant, even in unfavourable conditions. What's more, the reading is accurate to within ½%.



ATH6

PRICE
(complete with strong case and full range of accessories)
£14.14.0
2/10 postage and packing extra.

ATH7

ATH10

SMITHS HAND TACHOMETERS
can be used for checking:—

Rotational speeds of shafts, spindles, gears, rotors and rolls.

Linear speeds in ft/min or metres/min of metal strips, textiles, paper, wire, plastic, film and conveyed material.

Surface speeds in ft/min or metres/min of cutting or grinding operations of machine tools, processing rolls, unwind rolls or wind up rolls for extrusion and strip production.

Readings can be taken in bad lighting conditions or where the dial is visually obscured.

AVAILABLE IN CHOICE OF FOUR MODELS:—

Model A.T.H. 4	illustrated	(0-50,000 r.p.m.)
Model A.T.H. 6	dial illustrated	(0-10,000 r.p.m.)
Model A.T.H. 7	dial illustrated	(0-20,000 r.p.m.)
Model A.T.H. 10	dial illustrated	(0-5,000 r.p.m.)

ALL FOR L.H. OR R.H. DIRECTIONS OF ROTATION

POST THIS FOR FULL DETAILS

Please send full details of your HAND TACHOMETERS

NAME _____

ADDRESS _____

_____

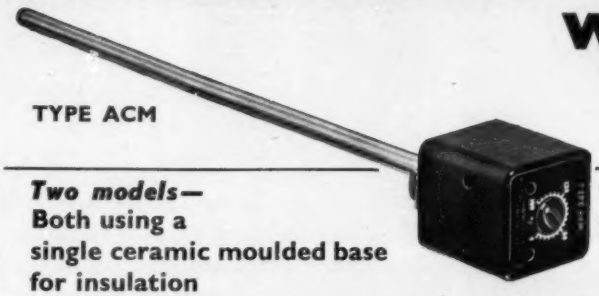
_____

SMITHS INDUSTRIAL INSTRUMENT DIVISION

Chronos Works, North Circular Rd., London, N.W.2. Tel: GLAdstone 1136

MACLARENS *Latest* WATER HEATER THERMOSTATS *are of revolutionary design*

TYPE ACM



Two models—
Both using a single ceramic moulded base for insulation

Completely redesigned to ensure better performance with thorough reliability, accuracy, simplicity and strength

THERE IS NOTHING TO GO WRONG

TYPE MB

TYPE ACM

Enclosed in moulded Bakelite cover which insulates the terminals. Double break; straight-through connections; no current passes through snap spring mechanism.
RATING: 25 amps at 250 volts.
RANGE: 15/90° C. or 60/190° F. for 11 in. stem.

TYPE MB

A simplified version of the ACM. Produced to meet the need for a smaller instrument at lower cost. Uninsulated terminals, limited range of adjustment or fixed setting.
RATING: 15 amps at 250 volts.
RANGE: 20° C. or 40° F., e.g. 70-90° C. or 140-180° F.

ROBERT MACLAREN & CO. LTD., Eglinton Works, Kilbirnie Street, GLASGOW, C.5, SCOTLAND

Representatives in
LONDON, MANCHESTER, PARIS, BRUSSELS, ROTTERDAM, PORTUGAL, NORWAY, SWEDEN, ISRAEL, SOUTH AFRICA, AUSTRALIA, AND NEW ZEALAND

---

high speed COUNTERS

- Instantaneous Mechanical or Electrical Reset
- Up to twenty-five Counts per second
- Auxiliary Contacts
- Four or Five Digits
- Compact and Robust Construction
- Wide range of D.C. Voltages
- Low Consumption

★ Now made in Britain to Swiss design ★

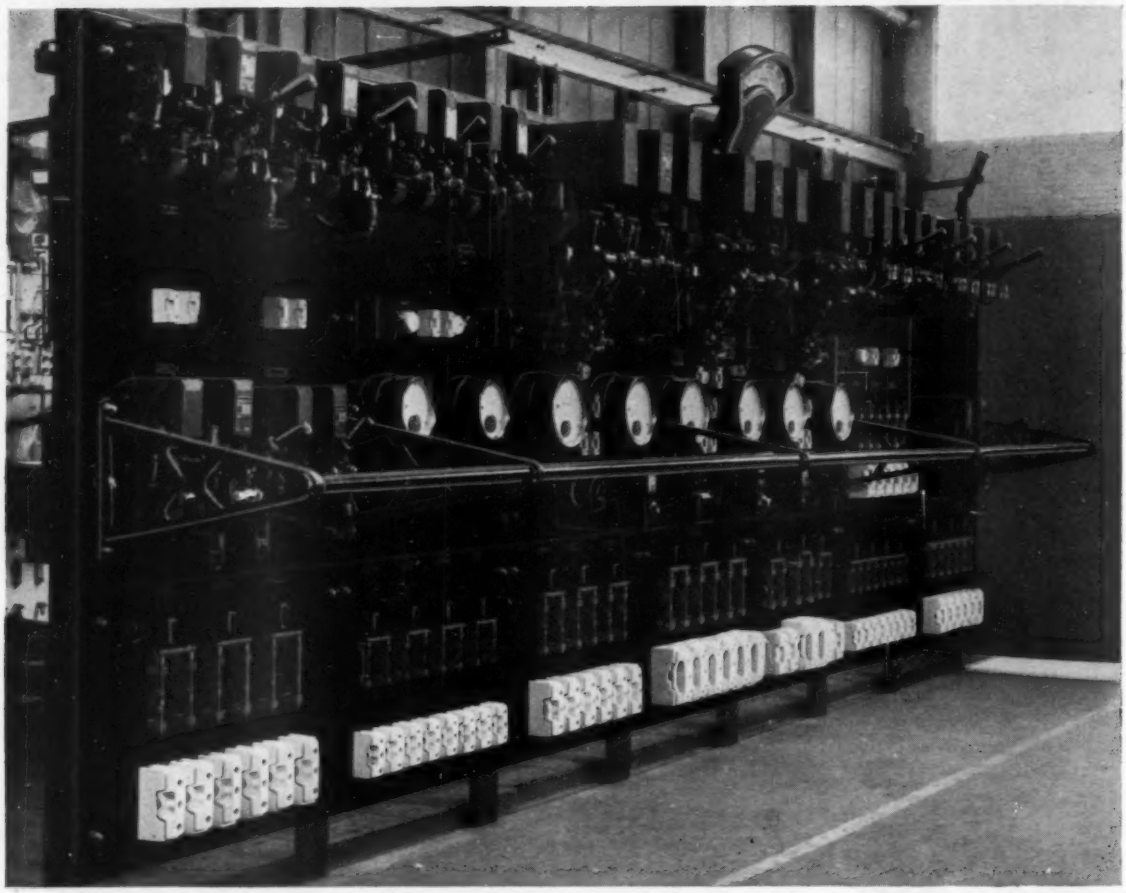
Full details from:

STONEBRIDGE CONTROLS & INSTRUMENTS
THE STONEBRIDGE ELECTRICAL CO. LTD.
6 Queen Anne's Gate · London S.W.1
Telephone: TRAfalgar 1444

J. F. RATCLIFF (METALS) LTD.

NEW SUMMER ST., B'HAM 19

Phone: ASTON CROSS 3576 P.B.X. Grams: "ROBENT, B'HAM 19"



Switchboard built by the Sunderland Forge & Engineering Co. Ltd.

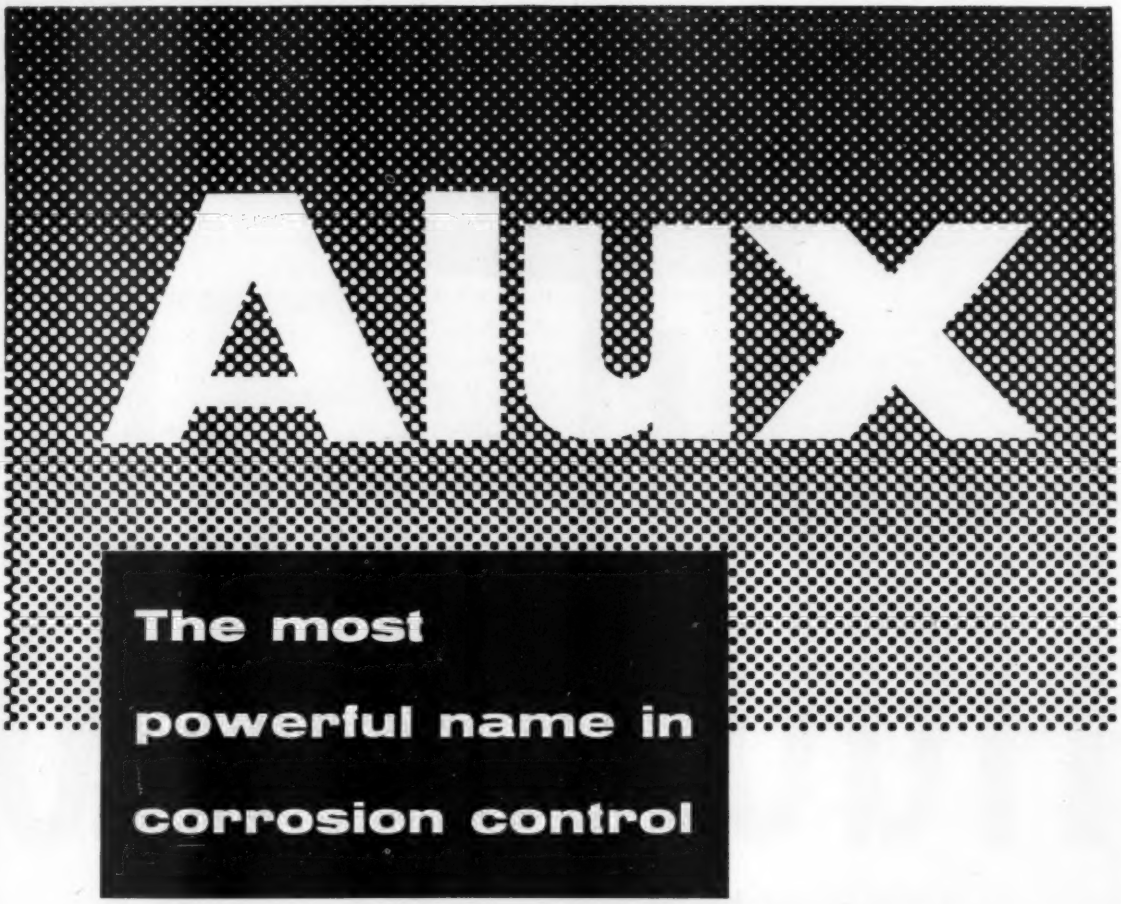
SWITCHBOARD BASES

by

INTEROHM

Above you see a large switchboard carrying circuit breakers, knife switches, porcelain fuses, instruments etc. The base is of polished Interohm, the long-life insulating material. It is produced in natural grey for arc shields, barriers, and boxes. Also in impregnated polished sheets for switchboard bases and as mounting boards for electrical components. Interohm has excellent machining qualities and is highly resistant to extremes of temperature.

INTEROHM ELECTRICAL INSULATORS LTD., Freemantle Road, Lowestoft



We are proud to introduce a revolutionary aluminium finishing process which will be of vital interest to a large number of industries.

Briefly, ALUX provides a glass-hard, non-corrosive surface in any colour or texture.

One application is for light or heat reflectors. ALUX gives a higher reflectivity percentage than any conventional material with a maintained efficiency in spite of thermal and corrosive attack.

We shall be glad to receive inquiries from manufacturers and advise them on the use of the ALUX process in any type of product where its unique properties would be of value.

—VERITYS LIMITED · ESTABLISHED 1819
BRETTENHAM HOUSE, STRAND, W.C.2

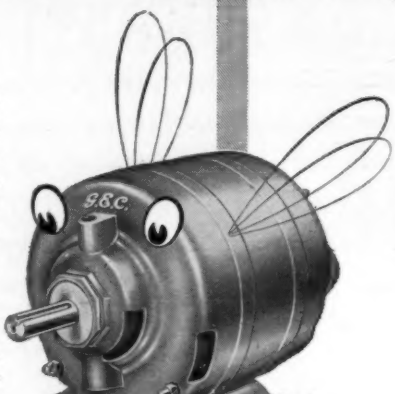
and at BIRMINGHAM · BRISTOL · GLASGOW · MANCHESTER and NEWCASTLE-ON-TYNE

G.E.C.

Fractionals

put power where you want it

Power for many purposes. Power to drive your own plant efficiently, or to add further distinction to the equipment you make and sell. Power. As much (up to 1 h.p.) or as little as you need, in a wide range of mountings, but always with the reliability for which all G.E.C. engineering is famous. Power, from sturdy, dependable G.E.C. Fractionals. Most sizes and mountings are held in stock—that's another advantage of dealing with the G.E.C.



G.E.C. manufacture many types and sizes of fractional motors for light industrial and domestic drives—whether for your plant or products our engineers will always be pleased to help you choose the right motor for the job.

Fully detailed illustrated publication on application.

The Busy Bee from G.E.C.

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13. 5%: 26. 10%: 52. 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

GOVERNMENT OF MALTA

Water Supply

TENDERS are invited by the Maltese Government for the supply and erection of Water Pumping Plant for three pumping stations on the island of Malta. The plant required consists of a total number of five electro-submersible pumping sets each rated at about 8,000 g.p.h., complete with motors, starters, switchgear, instruments, pipework, cabling, etc.

Tender documents and drawings may be obtained at the office of the Treasurer, The Palace, Valletta, Malta, or at the office of the Engineers, Messrs. Binnie, Deacon & Gourley, Artillery House, Artillery Row, Westminster, London, S.W.1, on payment of Two Pounds for each copy of the documents, on or after Wednesday, 4th June, 1958.

Sealed tenders in duplicate in a plain envelope endorsed "Tender for Water Pumping Plant, etc., for Binjemma, Falka and Mgarr," shall be delivered at the office of the Treasurer, The Palace, Valletta, Malta, not later than 10 a.m. on Thursday, 31st July, 1958.

The Maltese Government do not undertake to accept the lowest or any tender, and will not defray any expenses incurred by tenderers who will, nevertheless, be presumed to have acquainted themselves fully with the site and conditions of the work.

THE TREASURER, MALTA.
3592

SWANAGE URBAN DISTRICT COUNCIL

Public Street Lighting

TENDERS are invited for the supply and erection of 9 140-watt Sodium Lamps mounted at 25 ft. on reinforced concrete columns, 235 60-watt Sodium Lamps mounted at 15 ft. on reinforced concrete columns, and 39 45-watt Sodium Lamps mounted at 15 ft. on reinforced concrete columns.

Particulars can be obtained from P. S. Browne, F.R.I.C.S., Surveyor and Water Engineer, Town Hall, Swanage.

Tenders, in plain sealed envelopes, endorsed "Street Lighting," should reach the undersigned not later than noon on Saturday, 28th June, 1958.

The Council does not bind itself to accept the lowest or any tender.

W. A. P. BALE,
Clerk of the Council.
Town Hall,
Swanage.
21st May, 1958. 3641

COUNTY BOROUGH OF SOUTHEND-ON-SEA

THE Council invite tenders on a fixed price basis for the supply, laying, jointing and testing of approximately 2,360 yards of 3-core .1 sq. in. 11-kV Polythene insulated copper tape screened served single wire armoured P.V.C. sheathed overall cable on Southend Pier.

Specifications, forms of tender and conditions of contract may be obtained from the Pier Manager, Pier Hill Buildings, Pier Hill, Southend-on-Sea.

Tenders, on the form supplied, in a plain sealed envelope endorsed "H.T. Cable, Southend Pier, Tender," must reach me not later than Wednesday, 9th July, 1958.

No guarantee is given that the lowest or any tender will be accepted.

ARCHIBALD GLEN,
Town Clerk. 3622

BOROUGH OF CHELTENHAM

Trunk Road Lighting

London-Fishguard Trunk Road

TENDERS are invited for the supply and erection of a Group "A" Lighting Installation as follows:—

Bill No. 1: For the supply only of 90 140-watt sodium lanterns and 49 3 × 80-watt fluorescent lanterns together with ancillary equipment.

Bill No. 2: For the supply and erection of 99 steel columns together with fitting and wiring of tenderer's own lighting equipment.

Bill No. 3: As Bill No. 2 but for fitting and wiring of equipment offered by another firm.

Specification, bill of quantities and form of tender can be obtained from the undersigned on payment of a deposit of three guineas, which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Tenders together with fully priced bills of quantities are to be submitted in the envelope provided to reach the Town Clerk, P.O. Box No. 12, Municipal Offices, Cheltenham, not later than first post Monday, 23rd June, 1958.

The Council reserves the right to treat each bill of quantities as a separate tender, and does not bind itself to accept the lowest or any tender.

G. GOULD MARSLAND, M.B.E.,
Borough Engineer.
3642

SITUATIONS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division
S/13.1005

APPLICATIONS are invited for the following position:—
ASSISTANT ENGINEER
(Electrical Maintenance),
EARLEY GENERATING STATION.

Applicants should have had appropriate experience in a modern generating station. Manufacturing works experience will be an advantage. A sound technical training is essential and applicants should be studying for qualifications leading to Corporate Membership of an appropriate professional institution.

Salary N.J.B. Grade G.7, £935-£995.

Special application forms, obtainable only from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 11th June, 1958.
3652

ELECTRICAL ENGINEER

A VACANCY has arisen in the London West End head offices of a very large sub-contracting organisation for an
ELECTRICAL ENGINEER
with extensive experience of design, estimating and supervision of all types of contracts. This is a senior position and applications are only invited from engineers engaged on similar work with large sub-contractors. Outside staff will not be considered. The successful candidate will be required to be responsible for contracts from the initial enquiry stages through to completion.

Salary up to £1,250 p.a.

Please write giving full details of age and experience to—Box 3611.

CENTRAL ELECTRICITY GENERATING BOARD

Research and Development Department

CANDIDATES who have a strong inclination towards research and development work for its own sake are invited to apply for appointments as INSTRUMENT ENGINEER and COMBUSTION AND TESTING ENGINEER.

Initially the work will be on a super-heater test rig at Littlebrook Power Station in connection with the development of a new type of steam power cycle, and the first duties will be to assist in the completion of erection of this test rig and in the series of tests contemplated. At a later stage the work may be transferred to other centres of activity depending on the manner in which various projects come to fruition.

For the Instrument Engineer post, which will be based at Leatherhead, candidates should preferably have served an instrument engineering apprenticeship and should be thoroughly familiar with the use of instrument engineers' lathes and other precision tools. They should also have a wide practical knowledge of instrumentation as applied to a modern power station or other complex industrial process, and it would be an additional advantage to have sufficient knowledge of electronics to maintain potentiometric and other types of instruments involving electronic circuits.

For the Combustion and Testing Engineer post, which will be based at Bankside House, London, S.E.1, candidates should have served a mechanical engineering apprenticeship and have a wide experience of mechanical engineering construction and maintenance as applied to shipping or power stations, and should be able to assist in the erection of test rig components and pipe work of all kinds. They should also have a wide practical knowledge and experience of the combustion of all grades of fuel oil either in ships or in power stations, pulverised coal in conventional power station practice, and of the considerable variety of equipment at present on the market to carry out this operation. A knowledge of electric welding would be an additional advantage.

Salaries £820-£1,265 p.a. according to ability and experience plus London allowance where applicable.

Application forms obtainable from S. S. Scott, Chief Personnel Officer, Central Electricity Generating Board, 24-30, Holborn, London, E.C.1, should be completed and returned by 18th June. Envelopes should be marked "Confidential," quoting reference ER/139. 3608

AIR MINISTRY

WORKS Design Branch requires in LONDON and PROVINCES ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in London up to £870 p.a. Somewhat lower in Provinces. Starting pay dependent on age, qualifications and experience. Long-term possibilities with promotion and pensionable prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. BOROUGH 104. 253

Situations Vacant (continued)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chief Commercial Officer's Department
Area Headquarters

SENIOR ASSISTANT ENGINEER (Commercial),
Planning, Policy and Development Section
(60/58.R).

The Board operates a vigorous sales policy and the successful candidate will be required to assist the Section Head in the study of special problems, the preparation of periodic reports, the administration of commercial policy, and the preparation of commercial information for dissemination throughout the area.

Preference will be given to an applicant with good technical and administrative ability, and a sound knowledge of the utilisation of electricity for all domestic, commercial, industrial and agricultural purposes. His previous experience should include the negotiation of street lighting contracts, the sale of appliances and fittings and the successful operation of a comprehensive electrical installation, contracting and maintenance department.

Salary N.J.B. Class AX/EX, Grade 2 (£1,435 × £25 to £1,560–£1,700).

Apply by letter, within 14 days, to the Chief Commercial Officer, Eastern Electricity Board, Wherstead, Near Ipswich.

Northmet Sub-Area

SUB-AREA HEADQUARTERS
SOUTHGATE, LONDON, N.14
FOURTH ASSISTANT ENGINEER
(Ref. 788) (61/58.R).

Candidates should have had a sound technical training up to at least Higher National Certificate standard, have a knowledge of substation plant and protective gear, be experienced in the design and layout of substations, and be capable of supervising site works.

Salary N.J.B. Class M, Grade 13 (£885–£930), plus London allowance.

Apply by letter to S. F. Osborne, M.I.E.E., A.C.I.S., A.M.B.I.M., Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, by 13th June, 1958. 3655

CITY OF SALISBURY SOUTHERN RHODESIA

Vacancies for Assistant Shift Charge Engineers

APPLICATIONS are invited for the fixed establishment posts of ASSISTANT SHIFT CHARGE ENGINEERS on the grade £1,350 × £50 to £1,500 per annum, commencing salary at the minimum of the grade. No cost of living, shift or other allowances are payable.

Candidates must have completed an approved course of technical education in electrical and mechanical engineering and the possession of appropriate technical qualifications will be an advantage. They must also have had considerable practical experience in the operation of steam power station plant in a responsible position, and experience of control room duties on an interconnected system will be a recommendation.

The appointments are subject to Council's service and leave regulations as amended from time to time and successful applicants will be required to submit satisfactory medical certificates of fitness. They must also be able to comply with the requirements of the immigration authorities.

Applicants who should not be more than 45 years of age, are required to submit full particulars of their technical education, qualifications if any, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Further particulars regarding the undertaking, conditions of service, contributions towards travelling and removal expenses, etc., may be obtained from Davis & Soper, Ltd., 52/54, St. Mary Axe, London, E.C.3, to whom applications should be sent to arrive not later than 16th June, 1958. 3560

A DEPUTY CHIEF ENGINEER

required for a lead acid Accumulator Division. Essentials are :—

1. Practical experience of electrical and electro-chemical work.
2. Sound theoretical knowledge of inorganic chemistry.
3. Ability to carry responsibility.

Practical experience should have been gained on both laboratory and production problems. A high measure of technical competence is essential, but an academic degree is not actually necessary. Knowledge of lead acid battery industry highly desirable. The right applicant will quickly become Chief Engineer with a large measure of independent responsibility for extensive future developments. The post carries a good pension and competitive salary.

Write Chief Engineer, Accumulator Division, Siemens Edison Swan Ltd., Ponders End, Middlesex. 3594

BRITISH INSULATED CALLENDER'S CABLES LIMITED

invite applications from

QUALIFIED
ELECTRICAL ENGINEERS AND
PHYSICISTS

for technical appointments in their Power Cables Division at Belvedere, Kent. Excellent prospects for men of ability and initiative. Salaries £750 to £1,200 dependent upon age, qualifications and experience. Pension fund. Canteen. Sport and social facilities. Pleasant working conditions.

1. For high-voltage cable design and development.
2. For cable accessories design problems and electrical field plotting.
3. For very high voltage testing of cables and accessories, involving operation of 3.2 MV impulse generator and H.V. A.C. testing equipment.
4. For design and calculation of supertension cable systems for tendering purposes. Some previous experience and ability to write clear concise reports essential.

QUALIFIED CHEMISTS,
DEGREE OR A.R.I.C.

for control of manufacturing materials, with investigational and development work connected therewith. Experience of thermo-plastics advantageous.

Apply, in writing, to the Staff Officer.

3606

EAST MIDLANDS ELECTRICITY BOARD

Northamptonshire Sub-Area

APPLICATIONS are invited for the post of JOINTER (E.H.T.) in the Sub-Area Development and Construction Department at Northampton. A wide experience of 33-kV cable jointing is essential.

Wages (at present 55.5d. per hour) and conditions of employment in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry.

Applications in writing should be made to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, so as to reach him within ten days of the issue of this advertisement. 3646

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

Office of The County Architect

APPLICATIONS are invited for the appointments shewn below:—

ASSISTANT ARCHITECT at Divisional Office, Doncaster. Special Grade £750–£1,030.

ELECTRICAL ENGINEERING INSPECTOR at Divisional Office, Wakefield. Grade APT.1 £575–£725.

ELECTRICAL ENGINEERING INSPECTOR at Divisional Office, Doncaster. Grade APT.1 £575–£725.

Applicants for the post of assistant architect should have experience in the maintenance of buildings and of works of minor adaptations and improvements and be registered architects.

Candidates for the posts of electrical engineering inspector must possess the Ordinary National Certificate in Electrical Engineering and have had practical experience in inspecting, supervising and testing electric lighting and power installations and be able to prepare specifications and drawings for simple maintenance schemes.

The appointments are subject to the provisions of the Local Government Superannuation Acts.

Application forms, with conditions of service, are obtainable from this office and should be returned not later than the first post on Tuesday, 10th June, 1958.

A. W. GLOVER, F.R.I.B.A.,
Bishopgarth, County Architect.
Westfield Road,
Wakefield. 3647

ENGLISH ELECTRIC

Control and Electronics Division

require

ELECTRICAL ENGINEERS with experience in the design and development of small servo-mechanisms or the application of

ANALOGUE COMPUTER

techniques, to join an expanding team undertaking a wide variety of simulation studies. Applicants should have H.N.C. or possess comparable qualifications. Housing assistance can be offered after an initial period, and the team operates at a new expanding works situated on the Staffordshire / Cheshire border.

Attractive staff pension scheme and three weeks' annual holiday from next year.

Applications giving full details of qualifications and experience should be addressed to Dept. C.P.S., Marconi House, 336/7, The Strand, London, W.C.2, quoting reference ER.306H.

3614

THE BANK OF ENGLAND PRINTING WORKS

requires an ASSISTANT TO THE PLANT ENGINEER for the planning, installation and maintenance of plant in new premises. Candidates should be British by birth, aged between 25 and 30 years, and have H.N.C. Electrical (or equivalent). Non-contributory pension scheme. Housing loan facilities in approved cases after an initial period of service.

Write giving full particulars, including age, to the Staff Manager, Bank of England Printing Works, Langston Road, Loughton, Essex. 3615

AN ELECTRICAL CONTROL GEAR DESIGNER

FIRM of electrical control gear manufacturers require a Design Engineer with experience in automatic and hand-operated control gear and panels. Knowledge of electronics desirable but not essential. Attractive remuneration and conditions.—Box 3567.

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

APPLICATIONS are invited for the following positions :—

GENERAL ASSISTANT ENGINEERS (S/13.1003).

Applicants should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education, and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include as a general rule the operation and control, under supervision, of generating plant. A number of these vacancies are at the oil-firing stations at Marchwood, near Southampton, and Poole.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Salary N.J.B. within scales £540-£730.

Special application forms, obtainable only from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 11th June, 1958.

3625

A PROFESSIONAL ENGINEERING APPOINTMENT

in the field of

ELECTRICAL POWER SYSTEMS STUDY

THE ENGLISH ELECTRIC COMPANY, STAFFORD, is interested in appointing a qualified electrical engineer or physicist to conduct theoretical investigations and analytical studies into problems concerning electrical power systems.

Engineers with a keen analytical mind wishing to work in the challenging field of power systems engineering are invited to apply. This work offers an unusual opportunity to gain valuable experience in the generation and distribution of electrical power.

Please write giving full details to—

Dept. C.P.S.
Marconi House, 336/7, The Strand, London, W.C.2

quoting reference ER.1218W.

3612

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

125

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointment in this Division :—

FOURTH ASSISTANT ENGINEER, STAYTHORPE TRANSMISSION SECTION (Vacancy No. 81/58.ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 4th June, 1958.

This appointment will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, anad should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

16th May, 1958. 3607

DEVELOPMENT ENGINEERS

'ENGLISH ELECTRIC' STAFFORD

THE company wishes to appoint a limited number of ELECTRICAL and MECHANICAL DEVELOPMENT ENGINEERS to contribute to the company's leading position in the field of large rotating machines.

The work is concerned with theoretical and experimental investigations into a variety of machine types. These projects are of a fundamental nature leading directly to improvements in design and performance.

These appointments will in general be open to engineers of higher academic attainments with relevant background experience which can well have been obtained in parallel fields. The appointments are permanent and command high salaries. The company's advanced pension scheme carries additional life assurance benefits.

We will be pleased to arrange Saturday morning interviews where necessary.

Please write giving full details to Dept. C.P.S., Marconi House, 336/7, The Strand, London, W.C.2, quoting reference ER.1203B.

3613

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

THIRD ASSISTANT ENGINEER is required in the System Development Section of the Technical Department at Headquarters, Moseley, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule B, Grade 6, commencing at a point commensurate with qualifications and experience within the range £895-£1,020 per annum, ultimately rising to £1,140.

Applicants should possess qualifications equivalent to Graduate I.E.E. and should have had practical training either in the supply industry or with a switchgear manufacturer. They should also have held a position involving transmission system planning, and should have a sound knowledge of the calculations involved, and of the design and operation of such systems.

Apply, quoting Vacancy No. 802MD on form AE6 available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 19th June, 1958. 3555

CENTRAL ELECTRICITY GENERATING BOARD

RESEARCH AND DEVELOPMENT DEPARTMENT, HEADQUARTERS, LONDON, require young graduate engineers of honours standard in mechanical or thermodynamic power engineering to assist in the development of a new type of thermodynamic power cycle at present being developed by the Board.

At the moment this work is centred in the erection of a superheater test rig at Littlebrook Power Station and the first duties of the successful applicant will be to assist in completing erection of this test rig, to install instruments and to assist in the series of tests contemplated.

The information derived from these tests will be used to design and construct a complete power unit of about 15-MW capacity. The purpose of the development is to achieve a radical improvement in the thermo efficiency of coal and oil consuming, and later, of nuclear plant.

Salary £590-£1,315 p.a. inclusive, according to ability and experience.

Application forms obtainable from S. S. Scott, Chief Personnel Officer, Central Electricity Generating Board, 24/30, Holborn, London, E.C.1, should be completed and returned by 14th June, 1958. Envelopes should be marked "Confidential," quoting reference ER/140.

3609

CONSULTING ENGINEERS REQUIRE ENGINEER FOR MIDDLE EAST

APPLICATIONS are invited from fully qualified electrical/mechanical engineers for the post of ENGINEER in the Middle East office of an important firm of consulting engineers.

Applicants should be Corporate Members of the Institution of Electrical Engineers or the equivalent, and must have had experience in an electricity supply undertaking, particularly on 11 kV and L.T. networks and substations.

The appointment would be for two years in the first instance at a fixed salary of ID.200 a month (one Iraqi Dinar = £1 sterling). A house with heavy furniture will be provided rent free. Three months' leave on full salary will be granted on satisfactory completion of the contract, together with first class air passages for the successful applicant and his wife, and children up to the age of 16 years.

Applications must include full details of training and experience, together with a recent photograph and copies of recent testimonials.—Box 3617.

ELECTRICAL DESIGN AND DEVELOPMENT

Expansion provides opportunity for enthusiastic men technically qualified to H.N.C. standard or higher. Our immediate need is for:—

DESIGN ENGINEERS for work on control circuits; experience should include electronic and magnetic amplifier control of electrical rotating machines.

These appointments, and others which we expect to make shortly, offer both absorbing interest and satisfying reward.

If you believe you can qualify for a place in our specialist design team please reply now, including age and salary indication.

Confidential treatment ensured by addressing:—

Chief Electrical Designer,
VERNONS INDUSTRIES LTD.,
Kirkby Industrial Estate,
Liverpool.

3564

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

Southern, Midlands and Northern Project Groups

APPLICATIONS are invited from suitably qualified engineers for appointments as ENGINEER-IN-CHARGE of Drawing Office in the Southern, Midlands and Northern Project Groups located in London, Birmingham and Manchester respectively.

The Engineer-in-Charge will be responsible to the Chief Project Engineer for the administration of the Project Drawing Office, in which there will be a substantial aggregation of draughtsmen to serve the project teams. Experience in the control of drawing office staff engaged in work associated with the design and construction of modern power stations or similar heavy engineering work is essential.

Candidates may indicate a preference for any of the three posts.

Provisional salary range £2,300–£2,500 per annum plus £60 London allowance for the Southern Project Group post.

Applications, stating age, qualifications, experience, present position and salary, should be forwarded to S. S. Scott, Chief Personnel Officer, 24-30, Holborn, London, E.C.1, so as to arrive not later than 7th June. Envelopes should be marked "Confidential," quoting ref. ER/138. 3610

SALES ENGINEERS

are required by old-established electric motor manufacturers for the following areas :—

(i) London and Home Counties.
(ii) West of England and South Wales.

These are new appointments arising out of expansion of the company's outside sales staff and provide scope for men who are keen to sell first-class products.

Candidates should have good knowledge of electric motors and generators and their applications, and should preferably hold a Higher National Certificate or equivalent qualification.

Salaries in accordance with experience and qualifications. The appointments will include entrance to the company's pension scheme.

Please write, giving full particulars, including education and technical training, to Personnel Manager, Small Electric Motors Ltd., Beckenham, Kent.

3626

CHIEF DRAUGHTSMAN MOTOR CONTROL GEAR

ESTABLISHED and expanding firm of control gear manufacturers invite applications for the post of

CHIEF DRAUGHTSMAN.

Applicants should have had extensive practical experience in the design, layout and development of multi-motor control boards, particularly as regards equipment built to meet customers' special requirements, and be capable of carrying full responsibility for drawing office output and personnel.

Essential qualities are initiative, ability to organise, and a systematic approach.

Applicants should be between the ages of 30 and 45.

Apply in writing, giving details of age, experience and qualifications, to the Secretary, Morecambe Electrical Equipment Co. Ltd., Westgate Works, Morecambe, Lancs.

3481

EAST MIDLANDS ELECTRICITY BOARD

Third Assistant District Engineer, Boston District, Lincolnshire Sub-Area

APPLICATIONS are invited from suitably qualified and experienced engineers for the position of THIRD ASSISTANT DISTRICT ENGINEER in the Boston District of the Lincolnshire Sub-Area.

The duties of the appointment will consist of assisting in the planning, construction, operation and maintenance of underground and overhead networks up to and including 11 kV. Applicants should be capable of carrying out distribution schemes from the initial planning stage to final commissioning.

Ability to drive a motor vehicle is essential and the successful applicant will be required to undertake standby duties and reside in or near Spilsby.

The salary and conditions of the appointment will be in accordance with the National Joint Board Agreement, Class E, Grade 8 (£790 × £15 to £835 per annum).

Applications, giving details of age, education, qualifications, experience and position held, should be forwarded to the Manager, Boston District, Besco House, Market Place, Boston, so as to reach him within fourteen days of the issue of this advertisement. 3623

JOSEPH LUCAS (ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

YOUNG MAN

required for Contracts Department

of an old-established Engineering Firm handling Railway Equipment, including Lighting and Heating.

The duties will be compilation of estimates and preparation of tenders for submission to railways and carriage builders throughout the world.

Applicants should preferably have had practical experience in electrical work and should have reached at least Ordinary National Certificate standards.

Please write :

Box 2VR 02054, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2.

3653

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ASSISTANT ELECTRICAL ENGINEER, Special Grade, £750–£1,030 p.a. plus £30 p.a. London allowance. Must be A.M.I.E.E. and experienced in electrical services in buildings.

Full details, present salary and 3 copy testimonials to County Architect,, County Hall, Kingston-on-Thames, as soon as possible. 3643

HYDRO-ELECTRICAL ENGINEER

with Mechanical Engineering Experience

wanted for a large mining company situated in Upper BURMA, climate sub-tropical and healthy. Applicants must have technical qualifications with mechanical and electrical experience in the installation and parallel operation of generators and be able to take charge of a HYDRO-ELECTRIC power station which has an installed capacity of 10,000 kVA, and equipped with Francis reaction turbines and generators at 3.3 kV, 3-phase, 50 cycles, and with transmission at 33 kV.

Four years agreement; six months paid leave of which three months normally permitted after two years; contributory provident fund; free passage; medical attention and partly furnished quarters. Salary and allowances aggregate K.1,740 (£130 10s.) per month.

Advise fullest details education, qualifications, experience, age and family status. Write Box C.607, Willings, 362, Gray's Inn Road, London, W.C1. 3649

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable post:—

Worcester and District Sub-Area

PRINCIPAL ASSISTANT
(Sub-Area Accounting Dept.)
(Worcester).

Applicants should have extensive experience in stores and cost accounting, preferably within the electricity supply industry. Possession of a recognised accountancy qualification will be an advantage, as will experience in punched card accounting. Salary £1,035/£1,125 per annum (N.J.C. Grade 7).

Apply by letter, within 14 days, stating age, education, experience and qualifications to Mr. R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.
3654

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for the following superannuable post. Conditions of service in accordance with N.J.B. agreement, Schedule A. Salary includes London allowance.

FIRST ASSISTANT STATION CHEMIST TAYLORS LANE POWER STATION (Vacancy No. 58/375).

Applicants should be suitably qualified, have had experience in a power station laboratory and be fully conversant with the testing and analysis of fuels, oils and water. Salary Class F, Grade 9, £830 p.a.

Applications, quoting Vacancy No. to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 9th June, 1958. 3651

SOUTHERN ELECTRICITY BOARD

General Assistant Engineer

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class G, Grade 12 (£685 × £15 to £730 per annum). N.J.B. conditions of service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions and/or reinforcement to overhead and underground H.V. and L.V. networks.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.896, in envelopes suitably endorsed, not later than 9th June, 1958. 3644

ASSISTANT FOR INFORMATION BUREAU REQUIRED

PREFERENCE will be given to those having the following qualifications: knowledge of electrical engineering and physics, foreign languages and abstracting.

Please submit a concise statement of qualifications and salary required to the Secretary, Electrical Research Association, Cleeve Road, Leatherhead, Surrey. 3616

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

VACANCIES exist for ENGINEERING DRAUGHTSMEN (Electrical) in the Engineering Department, Electricity House, Love Lane, Liverpool, 3.

Applicants should have some experience of electrical plant layouts and diagrams of connections, and should have reached the Ordinary National Certificate standard in Electrical Engineering.

The salary payable initially will be within range £595/£715 per annum (N.J.B. Schedule D, Grade 6), with prospects of progress to Grade 5 (£760/£860 per annum).

Appointments subject to medical examination. Pension scheme.

Applications should be made in writing to the Establishments Officer at the above address. 3624

APPLICATIONS OF TRANSISTORS

AN exceptional opportunity exists for a well-qualified engineer or physicist to join, at a critical stage in its expansion, a group working on the development of new applications for transistors in power circuits. Applicants should have a sound knowledge of electronic circuitry and a wide experience of the use of transistors in switching and oscillator circuits. Appointment in the West London area.

Apply to—Box 3593.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER required in the Planning Section at No. 1 Sub-Area Headquarters, Liverpool. Salary within range £835/£880 per annum (N.J.B. L/13).

Applicants should be experienced in all aspects of the distribution of electricity, and possess knowledge of the technical and economic principles underlying the design of distribution systems. Technical qualifications desirable.

Special application forms, obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3, should be returned to him not later than the 10th June, 1958. 3645

PIRELLI-GENERAL CABLE WORKS LTD.

have vacancies for

TRANSMISSION LINE ENGINEERS and ASSISTANTS with experience on wood pole lines.

SURVEYORS with experience on steel tower and wood pole lines.

LINESMEN with wood pole lines experience.

Apply in writing stating age, experience and salary required to — The Manager, Overhead Lines Dept., Leigh Road, Eastleigh, Hants. 3595

TRANSFORMER DRAUGHTSMEN

SENIOR and JUNIOR DRAUGHTSMEN with experience on power transformers in range 5 to 10,000 kVA required. Permanent positions offering good salary according to experience. Pension, life assurance scheme, etc. Evening and Saturday interviews can be arranged. Write stating age, experience and qualifications to:—

Chief Engineer
BRYCE ELECTRIC CONSTRUCTION CO. LTD.,
Kelvin Works, Hackbridge, Wallington, Surrey. 3650

ASSISTANT ELECTRICAL ENGINEER

ELECTRIC motor control gear manufacturers require young Assistant in Design Office with knowledge of electronics. Progressive position, contributory pension scheme.—Box 3568.

CLASSIFIED ADVERTISEMENTS ARE PREPAID

DRAUGHTSMEN

SENIORS and juniors required for design and detail of medium voltage electrical switch and control gear for electricity boards, oil refineries, NC.B. and industrial installations. Men holding or studying for O.N.C. and having D.O. experience in the above class of work preferred. Excellent working conditions. 5-day week. Contributory superannuation plus free life insurance. Applications treated in strict confidence.

Apply, stating age, qualifications and salary desired, to Secretary, M. & C. Switchgear Ltd., Kirkintilloch, Nr. Glasgow. 3559

ATOMIC POWER CONSTRUCTIONS LIMITED

APPLICATIONS are invited for the post of INSTRUMENT ENGINEER, the duties involving the design, installation and commissioning of instruments in nuclear power stations. The position is a senior one, and chartered engineers interested are asked to apply to:—

The Secretary (Ref.: 8/ER)
Atomic Power Constructions Limited
28, Theobald's Road,
London, W.C.1. 3648

A SPECIALITY technical salesman required for unique range of industrial electrical equipment. Outstanding personality and initiative essential; must own car. Established connection with wholesalers and industrial users desirable. Salary £1,000 per annum, plus expenses. Write—Box 3664.

AN old-established British oil company has a vacancy in its overseas organisation in the East for an electrical engineer who would be responsible for the running and maintenance of a small turbo-alternator power station and all electrical distribution supplies. Applicants must have served a recognised apprenticeship and hold H.N.C. or equal. Attractive salary, currently augmented by cost-of-living allowance; generous home leave with passage paid both ways; kit allowance; medical attention; pension fund benefits and free furnished quarters. Write stating age, qualifications and full details of training and experience to—Box ER.399, c/o 191, Gresham House, London, E.C.2. 3656

ASSISTANT engineer required for design and circuit layout of automatic electric control equipment. Apply to — Control Gear Division, Electro Dynamic Construction Co., Bristol Road, Bridgwater. 3596

ASSISTANT required London electrical contractors. Must have drawing office and estimating experience. Write stating age, experience and salary.—Box 3569.

ASSISTANT sales representative required in London by manufacturers of electrical conduit systems. After training in preparation of quotations schemes and progressing orders, eventually to call upon architects, consultants and electrical contractors. Splendid prospects for young man with initiative and career outlook. Apply giving qualifications and previous experience.—Box 3618.

C. A. PARSONS & Co. Ltd., Heaton Works, Newcastle-on-Tyne, 6, have staff vacancies in their balancing department for young engineers with experience in electronics. Applicants should be in possession of H.N. Certificate or equivalent qualification and be clear of National Service. Write giving details of experience, etc., to the Employment Officer. 3627

CLERICAL assistant required by Crompton Parkinson Limited for their lighting section, London office. Duties include assistance in the preparation of estimates for lighting schemes, etc: Previous experience desirable but not essential. Applicants should be between 20-23 years of age. Write with full particulars to—Ref. MD/P2, Crompton House, Aldwych, London, W.C.2. 3628

CONSULTING engineers have vacancy for elec. eng., A.M.I.E.E. preferred, for design and supervision of contracts in hospitals, schools, factories, shipyards, etc. Variety of work with good prospects of advancement. 5-day week, superannuation, car allowance, salary according to qualifications and experience. Apply in writing to — R. W. Gregory & Partners, 54, Bloomsbury Street, London, W.C.1. 3657

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Good salary. Permanent and progressive position. Canteen, pension scheme. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 273

CONSTRUCTION engineer required for service in India. Must have experience in the planning and installation of factory services for large modern engineering factory. Experience in the installation and commissioning of medium to large precision machine tools is required, and a knowledge of accounting procedures is essential as successful applicant will be required to be responsible for local accounts. 3-year contract in first instance with prospect renewal. Salary, including allowances, up to Rs.2,700 per month, free quarters, medical attention, use of car, free passages for engineer and family, and other benefits. Apply giving details of age, experience, family circumstances, and when available, to—Secretary, A.E.I. Overseas Limited, Crown House, Aldwych, London, W.C.2. 3629

DESIGN draughtsmen. Men with a flair for original and imaginative developments in the light electro-mechanical field. An expanding concern now has additional vacancies carrying top salaries and excellent prospects for men of ability and experience. Modern working conditions with canteen. Sports and social facilities. Pension scheme. Write in first place to the Chief Draughtsman, Sangamo Weston Ltd., Great Cambridge Road, Enfield. 3658

DESIGNER-draughtsman, senior, electrical, required. Experience is preferred in the application of diesel-driven generating machinery up to 200 kW and its associated control gear, including portable, standby, automatic mains failure equipment, etc. Experience essential in control gear and circuit layout. Good salary offered. Pension scheme. Canteen facilities. Reply for the attention of the Chief Engineer, Henry Meadows Limited, Fallings Park, Wolverhampton. 3241

ELECTRICAL contract engineers. Opportunity for two young engineers to join staff of progressive company, one for electrical distribution and allied contracts, and one for internal work. Write giving full details, experience and age.—Box 3496.

ELECTRICAL contractors require branch manager in Lancashire. Applicants will be required to obtain enquiries and be completely in charge of contracts. State age and full particulars of previous engagements.—Box 3570.

ELECTRICAL engineer required for consultant's office. Applicant should be Higher National or A.M.I.E.E. standard. Salary up to £800 depending on experience. In reply please state age and experience to—Box 270, Robertson & Scott, 42, Charlotte Square, Edinburgh. 3659

ELECTRICAL engineer wanted, having practical and theoretical knowledge combined with commercial appreciation of electrical industry. Preference given to those possessing Corporate Membership, Institution of Electrical Engineers. Duties will include assessment of requirements and recommendations relative to tenders and contracts and to advise on electrical engineering of diesel-electrical projects and installations together with their costs. Only those who already have had experience with commercial side of electrical industry and qualify as above should apply. This appointment will carry with it a good salary and first-class pension scheme. — Box 3BQ9732, A. K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. 3585

ELECTRICAL engineers having B.Sc. or H.N.C. qualification and experience of electrical measurement are required for the design and development of indicating and recording instruments, relays, etc. Applications giving full details of experience, qualifications and salary desired will be treated in strict confidence. The company has a 5-day week, a contributory pension fund and a life assurance scheme. Please address your application to—The Secretary, The Record Electrical Company Ltd., Broadheath, Altrincham, Cheshire. 3631

ELECTRICAL testers required for work on all types of transformers up to 3,000 kVA. Previous electrical experience and some technical knowledge essential. Apply to the Personnel Officer, Foster Transformers, Ltd., South Wimbledon, London, S.W.19. 3566

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

***Situations Vacant** (continued)*

ESTABLISHED E.W.F. wholesaler shortly opening branch north of Birmingham requires an experienced representative, with a strong connection amongst industrial users, contractors, etc., to cover city centre and an area north of Birmingham. Only applicants with commercial experience and first-class connections will be considered for this position, which carries a high salary and eventually promotion to branch manager.—Box 3598.

EXPERIENCED shorthand typist (female) required, age over 30 years. Salary about £400 per annum. Hours, 9 a.m. to 5.30 p.m.; no Saturdays. Knowledge of electrical trade an asset. Telephone or write for appointment—(WATerloo 6056). Mr. J. D. Dow, Armorduct Cable Co. Ltd., 256, Westminster Bridge Road, London, S.E.1 (Three doors from the County Hall). 3660

FIRST-class representative required by Birmingham wholesaler, with knowledge of electrical contracting and domestic appliance trade. Must have life connection with contractors, electrical and radio shops and industrial users. Remuneration at least £1,000. Only top-grade men with several years' experience in similar trade should apply.—Box 3597.

FOREMAN. Electrical manufacturers, East Lancs. Experience of assembly and wiring of control gear necessary. Knowledge of sheet metal work and light machining an advantage. Good disciplinarian required. Assistance with housing.—Box 3444.

GREENGATE & IRWELL RUBBER Co. Ltd., Manchester, require a technical assistant for their cable department. Higher National Certificate (elec.) is a minimum requirement; previous experience in cable manufacture would be a great advantage. Apply in confidence to—Personnel Officer, Greengate & Irwell Rubber Co. Ltd., Greengate Works, Manchester, 3. 3632

HEAD storekeeper required by E.W.F. wholesaler to take charge of new branch north of Birmingham. Excellent opportunity for a fully experienced man able to control branch activities. Must be of smart appearance and have good personality to command. High salary envisaged.—Box 3599.

J. A. CRABTREE & Co. Ltd., Lincoln Works, Walsall, require senior designers with experience in domestic and industrial electrical accessory development. Applicants should be capable of initiating detail development with a minimum of supervision. Applications stating age, experience and salary required should be addressed to the Technical Director. 3504

JOSEPH LUCAS Limited wish to appoint a chief electrical engineer. Candidates should be suitably qualified and be Chartered Members of the Institution of Electrical Engineers. The candidates must have had considerable practical knowledge as the position involves advising the chief works engineer and senior executives of the company on major electrical projects in connection with new buildings and the installation and maintenance of plant and equipment. Applications should be made in writing to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Hockley, Birmingham, 19. 3633

JUNIOR designer, male or female, required for the transformer design office dealing with a wide range of problems from instrument transformers to power transformers and associated equipment. Apply giving details of past experience, age and salary to — Personnel Officer, Foster Transformers Ltd., South Wimbledon, London, S.W.19. 3619

PRODUCTION engineer/ratefixer wanted for modern electrical engineering company in India, manufacturing electric motors, transformers, switchgear, etc. This factory is at present working entirely on daywork, and an experienced production engineer is required to plan and put into operation a modern individual piecework system in machine shop, fabrication department, winding shop and final assembly. A man with previous experience in India preferred. Emoluments Rs.2,100 per month plus free unfurnished living accommodation, medical attention, car allowance and passages out and home; 3-year contract in first instance. Write stating age, experience, and whether married or single to the Secretary, A.E.I. Overseas Ltd., Crown House, Aldwych, London, W.C.2. 3630

SENIOR engineer required by well-known London electrical contractors. Write giving full particulars.—Box 3505.

REPRESENTATIVE. Sales engineer required in the Yorkshire area by well-known company manufacturing a range of cookers and home appliances. A young man with a connection with the Y.E.B., N.E.E.B., wholesale and retail electrical trade, can make this an excellent career. The possession of a car will be an advantage. Write giving full details of education, training and posts held to Manager.—Box 3431.

SALES engineer with some experience of electric motors required by large manufacturer for one of their branch offices. Some experience with staff administration desirable. Salary plus bonus based on turnover. Excellent prospects for ambitious man with expanding company.—Box 3574.

SENIOR electric rotating machines design engineer required by well-known manufacturer. Opportunity for a young man with progressive ideas, technical qualifications and sound experience, preferably on both A.C. and D.C. machines.—Box 3634.

SWITCHGEAR engineer responsible to the manager for all technical decisions in connection with design and application, including protection, for a manufacturer's range of switchgear including L.V. air and oil break gear and H.V. switchgear up to 33 kV. Reply in the first instance outlining qualifications, experience and salary to—Box 370.

SWITCHGEAR manufacturers invite applications for position of technical sales engineers to operate in the Scottish and Midlands areas, preferably resident in Glasgow and Birmingham respectively. Experience of switchgear and trunking systems would be of advantage and with connections in the area. Salary, commission, non-contributory pension scheme, and car provided. Apply Sales Manager.—Box 3543.

TELEPHONE engineers capable of switching-circuit development, including design and laboratory work, reqd. for progressive staff positions as engineers or technicians. Relative City and Guilds certificates desirable, but equivalent qualifications including experience acceptable. Good prospects and attractive conditions of employment with an A.E.I. company. Salaries according to age, experience and/or qualifications. Write with brief details to—Staff Officer, Ref. 744/11, Siemens Edison Swan Ltd., Woolwich, London, S.E.18. 3601

TEST room assistant required for testing single-phase and three-phase transformers, also small electrical equipment. Apply by letter or telephone stating age and experience to—The Zenith Electric Co. Ltd., Villiers Road, Willesden Green, London, N.W.2 (Telephone, Willesden 6581/5). 9374

WORKING foremen required by electrical contractors, London, W.C. area. Work mainly London. Good prospects. All London applicants interviewed.—Box 9356.

WORKS engineer required. Duties will involve knowledge of both mechanical and electrical engineering, building, woodworking, boiler plant and all services connected with the running of a large factory. Apply in writing giving details of experience and salary required to—Technical Director, Kelvin Works, Hackbridge, Surrey. 3620

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ELECT./mech. engineer, 36 years old, 20 years' general engineering experience, last 13 in East with considerable managerial experience, desires post U.K./overseas where courage, initiative and hard work can provide minimum salary of £1,250 per annum.—Box 9359.

ELECTRICIAN seeks job. All-round experience industrial power installation and maintenance. London district. Good refs.—Box 9373.

MANUFACTURERS' representative, domestic appliances, fifteen years' connection Electricity Boards and wholesalers, North-West area, seeks change.—Box B.903, Lee & Nightingale, Liverpool. 3603

REPRESENTATIVE, resident Bournemouth, seeks post with wholesalers or manufacturers, London, Hampshire and Home Counties.—Box 9370.

ARTICLES FOR SALE

ELECTRICAL EQUIPMENT FOR SALE

SIX WESTINGHOUSE Static 3-phase Converters. Specification 288.04. Input volts 400-440 or 200-250, single-phase. Output volts 400-440, 3-phase capacity, 4 kVA.

Each unit consists of :—

One DUBILIER condenser, A.P.F.4.
One static converter.
One 15-amp. switch.

The whole six for sale, or sold in separate sets.

Also :—

One FOSTER air-cooled Transformer, single-phase, 400-230 volts, 8 kVA.
One FOSTER oil-cooled Transformer, single-phase, 400-230 volts, 8 kVA.
One oil-cooled Transformer, single-phase, 415-240 volts, 25 kVA.

All in working condition.

Open to offers.

MORGAN & PARTNERS LTD.
Cowley, Uxbridge, Middx

3635

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Distribution Transformers for Disposal

THE Board have for disposal, and invite tenders for the purchase and removal of, 44 Transformers, of which 22 are serviceable as taken out of commission.

Further details, full particulars as to where they may be inspected, and forms of tender on which offers must be submitted may be obtained from the Manager, No. 4 Sub-Area, Merseyside and North Wales Electricity Board, Electricity House, Rhostyllen, near Wrexham.

Tenders must be returned in a sealed envelope as provided so as to arrive not later than noon on Friday, the 12th June, 1958.

The transformers are offered for sale without guarantee as to their condition, and the Board do not bind themselves to accept the highest or any tender and reserve the right to accept the whole or any part of the tender. 3621

ELECTRICAL EQUIPMENT FOR SALE

NEW ALLEN WEST OIL-IMMERSED CIRCUIT BREAKERS, pedestal type, 25-amp. and 70-amp. sizes, 400/3/50; also ELLISON Bantam 20-amp. ditto.

NEW 25-kW SPARE BULBS for HEWITTIC MERCURY ARC RECTIFIERS, type 100/3. NEW MERCURY ARC RECTIFIERS, input 200-250 v./3/50, output 110 v., 2-wire.

2 NEW 3-ph. TRANSFORMERS, 500 kVA, outdoor type, 6,600/440/250, and 2 ditto, 100 kVA, 3,300/440/250.

All above available at fraction of original cost.

BURLEIGH,
Alpine Works, Empire Way, Wembley, Mdsx.
3520

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Disposal of Non-Ferrous Scrap

THE Board invite tenders for the purchase of such Scrap Electric Cable of all types, together with Scrap Copper and Scrap Lead, as may become available for disposal during the current financial year ending the 31st March, 1959.

Forms of tender may be obtained on application to the Purchasing Officer, Electricity House, Love Lane, Pall Mall, Liverpool, 3.

The closing date for receipt of tenders is Saturday, the 14th June, 1958. 3531

AIRCRAFT GENERATORS

30-volt, 200-amp., D.C. shunt fitted spline shaft. Flange mounting. Ideal welding, lighting. £5 10s. each; del. free U.K. Cash with order, money back guarantee. Also pumps, cut-outs, regs., etc., etc. Stamp for list.

WYLLAN EQUIPMENT CO.
Dept. ER.1, 222, Waterloo Road, Manchester, 8
3590

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.
ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W.4. 57

BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

A.C. service lift. 2 cwt. at 70 ft.p.m., suitable for four floors. 30 ft. travel. Apply—Old Swan Hotel, Harrogate. 9371

ALTERNATORS from ½ to 675kVA in stock. single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works. Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

AVAILABLE immediately: One B.T.H. frequency changer, 20/25 kVA; one Wadkin 25-h.p., 440-volt, 3-phase stator unit; two Neco 23" diameter fan with 2-h.p., 400/440-v., 3-ph., 50-cycle electric motor. Apply—Leaderflush (Doors) Ltd., Trowell, Nottingham. 3636

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

B.T.H. motor alternating set on combination bedplate, comprising 6.6-kV driving motor, 710 h.p., 750 r.p.m., with exciter, direct coupled to single-phase alternator, 25 cycles, 120 volts, 4,000 amps. May be seen running at Universal Grinding Wheel Co. Ltd., Stafford. 3637

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS and motor-alternators, 24, 110 and 220v. D.C. to 230/1/50 A.C., 125 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

DOUGLAS wave winders (five) and Douglas magneto winders (three) for sale.—Box 3661.

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

ELLISON floor-mounting auto-transformer motor starter for operation on 400-volt, 3-phase, 50-cycle supply and full load rating at 60 amperes, with three magnetic hand reset over-current releases with adjustable oil dashpot time lags and 5" scale ammeter, calibrated 0-100 amperes. Transformer tappings at 50%, 60% and 75% of line voltage. All mounted in one steel case with plain cable entry and exit. Apply Surveyor, Crediton U.D.C., Parliament Street, Crediton, Devon. 3638

FLAMEPROOF switchgear, lighting fittings, conduit fittings, motors, etc., always in stock. —Leighton Warehouse Co., 6, Church Road, Linslade, Leighton Buzzard, Beds. (Tel. No. L.B. 3400). 9341

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues. — The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London. S.W.18 (VAN. 5234). 148

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc.—Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam. from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd.. Station Works, Bishop's Stortford. 163

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 5 amps., 17s. 6d.; 1s. 6d. postage.—Universal Electrical. 217-221, City Rd., London, E.C.1. 37

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTOR generators of all types in stock and to specification up to approx. 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 152

MOTORS, starters, circuit breakers. Huge stocks of all types, ¼ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

NEW, unpacked L.S.E. 1½-h.p. motors with A/West starters, 1,425 r.p.m., £12 set; ditto unused G.E.C., £11, delivered; 20-h.p. C.P. slipring, 920 r.p.m. starter, £40; also 17½-h.p. new slipring, Brook, 2,800 r.p.m., £35; 7/10-kVA P.F. condenser, as new, £15; all 400/440/3/50. — Plow, 6, Newport Road, Cardiff. 3639

PHASE converters, single to three-phase. several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London. N.1. 29

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings. 57s. 6d. each subject. — F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY Credit Meters, single & poly-phase, 2½-100 amps. From 17/6d. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

SLYDLOK fuses for sale.—Ryness Supplies, 37, Goodge Street, London, W.1. 284

SMALL BR screws and nuts in steel, brass and stainless steel, from stock. — Premier Screws & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters & Time Switches. Details from: Tradex Meter Co., Surbiton, Elmbridge 4487. 172

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

WELDING transformer by English Electric, 36 kVA, type FWC600.—Thomas Mitchell & Sons Limited. Bolton. 3452

WESTINGHOUSE static phase convertors. Input 240 v. or 400 v., single-phase. Output 400 v., 3-phase. Condition as new. £30 each.—Royle, 207/229, Essex Road, London, N.1. 3604

100-h.p. Igranic 220/250-volt D.C. contactor starter with speed regulator, manufactured 1952. £100.—Electric Machinery Co. Ltd., New Union Works, Ancoats, Manchester. 3545

162.5-kVA Paxman diesel alternator, 200 b.h.p., 1,000 r.p.m. Year 1956. Enquiries to—Box 3577.

329-kVA alternator by English Electric, 3/50/400 volts, 1,000 revs., single bearing machine suitable for direct coupling.—Thomas Mitchell & Sons Ltd., Bolton. 3451

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd.. Britannia Walk, London, N.1. 27

500-kVA, 3-bearing alternator by Crompton Parkinson; 3/50/415 volts, 700 amps. per phase, 600 revs.; on cast iron bed about 10ft. 6in. × 6ft., with rope pulley and control panel, new 1952.—Thomas Mitchell & Sons Limited, Bolton. 3450

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service. —Dawson-Keith Ltd., Hillview Rd., Sutton. Surrey (Fairlands 4401). 46

RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return. — Whitetrade Limited, Rochester, Kent (Tel. Chatham 41133, 3 lines). 294

ARTICLES WANTED

HARRINGTON & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc. — 109, Beaconsfield Street, New Beckton, East Ham. London, E.6 (ALB. 1388). 315

JOURNALS, periodicals, technical and scientific, wanted to buy for cash. Back volumes and sets. — E. R. Ashley, 27, East 21, New York, 10, N.Y., U.S.A. 61

MERCURY (Quicksilver) wanted. Write for packing instructions. Gold, silver and platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Rd., Watford (Tel. 5963). 114

SURPLUS laminations, enamel copper wire, screws, nuts, flex. Good prices paid. Full details to—Box 199.

WANTED, diesel engines and diesel sets.—H. Murfet, Daleside Rd., Nottingham. 240

Articles Wanted (continued)

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

DRAUGHTSMAN, free lance, electro-mech., requires work. Full D/O facilities including printing.—Beeline Printing Services, Beehive Lane, Chelmsford (Telephone 3397 and 4145). 9375

ENGRAVED nameplates and labels in all materials. — A. T. Brown & Co. Ltd., 347-349, Katherine Road, Forest Gate, London, E.7 (Tel. Grangewood 1024). 198

FLUORESCENT tube reconditioning service, guaranteed work, competitive prices.—E. J. Dawes Ltd., Erimus Works, Stockton St., Middlesbrough (Tel. Middlesbrough 2718). 282

METALWORK. All types cabinets, chassis, racks, etc., to your own specifications. Write—Dept. 'S,' Philpott's Metal Works Ltd., Chapman Street, Loughborough. 211

SMALL armature, stator, transformer and general coil winding undertaken on production run.—Kensal Electrics Ltd., 151, Kensal Rd., London, W.10 (LAD. 4530). 202

AGENCIES

ADVERTISER, twenty years' connection Electricity Boards and trade, seeks agency in North-West.—Box C.904, Lee & Nightingale, Liverpool. 3602

AGENTS required most areas for new "Plug-In" fluorescent units. Full details to—Box 3578.

ELECTRICAL accessories manufacturer wishes to contact hard-working agent already calling on wholesalers, contractors and public authorities in (1) N.E. England and (2) East Midlands. Full details to—Box 3508.

EXPORT agents seek additional lines. Small territories welcome.—Box 9368.

BUSINESS PREMISES

BELFAST. Shop in busiest arcade, right in centre. Ideal for T.V., radio and gram. records. Reasonable rental.—Box 3640.

FACTORY, warehouse, single storey, 13 ft. headroom, small canteen, office, 2 entrances. Gen. industry. Class IV. 7-10,000 sq. ft. E. London. Long lease.—Box 3662.

BUSINESS OPPORTUNITIES

MANUFACTURERS of quality fluorescent fittings, tubes, starters and control gear wish to contact quantity buyers, wholesalers, agents, etc., interested in purchasing in quantity at special low prices. Advertisers are interested in long or short term arrangements.—Box 213.

PATENT NOTICES

PATENT No. 701890 for "Improvements in or relating to electric water heaters." Owner desires to meet all demands for the utilisation of this patent and invites enquiries from manufacturers and others in Great Britain prepared to assist in its commercial exploitation. Address Pollak, Mercer & Tench, Audrey House, Ely Place, London, E.C.1. 3605

CLASSIFIED ADVERTISEMENTS ARE PREPAID

EDUCATIONAL

BRADFORD INSTITUTE OF TECHNOLOGY

Principal: E. G. Edwards, Ph.D., B.Sc., F.R.I.C.

FULL-TIME COURSE FOR PART III EXAMINATION OF INSTITUTION OF ELECTRICAL ENGINEERS

APPLICATIONS are invited for a SIX-MONTH course for the above examination, starting 6th October, 1958.

Applicants should have passed Part II, or obtained exemption therefrom by a suitable Higher National Certificate, with endorsements, but provision may be made for candidates to study engineering physics or thermodynamics while on the course.

Further details and forms of application may be obtained from the Principal, Institute of Technology, Bradford, 7. 3546

CITY & Guilds (Electrical, etc.) on "No Pass —No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook. Free and post free.—B.I.E.T. (Dept. 12A), 29, Wright's Lane, London, W.8. 100

LEARN electrical engineering the practical way. Our new self-study course includes equipment on which experimental work can be carried out. Also courses for all professional examinations. Free brochure from E.M.I. Institutes, Dept. ER57, London, W.4 (Associated with H.M.V.). 318

BOOKS, INSTRUCTIONS, ETC.

"INTRODUCTION to Valves." By R. W. Hallows, M.A.Cantab., M.I.E.E., and H. K. Milward, B.Sc.Lond., A.M.I.E.E. Describes the principles, construction, characteristics and uses of most types of radio valve. The approach is simple and, as far as possible, non-mathematical, but the book provides the student with a thorough understanding of valves and how they work. 8s. 6d. net from all booksellers. By post 9s. 4d. from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1. C4

BATTERY CHARGERS AND CHARGING

By Robert A. Harvey, B.Sc.(Eng.), M.I.E.E.

This invaluable book shows how the problems of battery charging and control have been solved in many different industries. It enables the engineer to examine the schemes used in other fields and to select and adapt such schemes for his own particular use.

Covers every important battery control scheme

35s. net. *By Post* 36s. 9d.

From booksellers or from Publishing Dept. Dorset House, Stamford Street, London, S.E.1

COMPANY MEETINGS

LONDON ELECTRIC WIRE COMPANY AND SMITHS

Total Output Maintained

THE Forty-ninth Annual General Meeting of The London Electric Wire Company and Smiths Limited was held on 22nd May in London.

Mr. E. L. Wildy, chairman and managing director, in the course of his speech, said:—

The Directors' Report and Accounts for the year 1957 have been circulated to stockholders, and I propose to comment upon the more important features.

The Group Profit for the year subject to taxation at £775,632 is £239,809 less than for 1956. In the course of the year the price of copper fell by £86 per ton to £181 10s. at the 31st December, 1957. The whole of the Group's working stock has been valued in the accounts on the basis of this price, and depreciation of £305,000 has had to be met. Fortunately, we had available a provision of £193,000 which has been used for this purpose, with the result that only £112,000 has been charged in arriving at the Group Profit.

Turning to the Consolidated Balance Sheet, you will see that the capital employed has increased marginally to £8.8 million. Liquid resources are still strong, though less than at the end of 1956 in spite of the fall in the price of copper. The reduction is mainly due to the payment during 1957 of substantial tax liabilities in respect of the record profits of 1955 and to the necessity to finance both a higher volume of stocks and a slightly longer period of credit to customers.

The equipment at our factories is now up to date and, although a certain amount of new plant continues to be installed in order to cater for changing demand and to increase efficiency, it can be said that our main expansion programme, started in 1954, was substantially completed in 1957. Productive capacity was, therefore, rather greater than in 1956; but the total volume of output in the year was approximately the same.

A Serious Factor

A serious factor of the year's operations was the continued increase in cost of certain items, such as fuel and transport, over which we have no control. In spite of improved methods of manufacture, we have been able to absorb only a part of these increased costs and, reluctantly, we have had to increase the selling prices for certain of our products. On the other hand, customers derived immediate benefit from the fall in the price of copper to which selling prices are geared. Some of these price increases, however, were introduced too late to have much effect on the year's results.

Difficulties following the Suez crisis, and credit restrictions, which in the second half of the year were greatly intensified, interrupted the normal rate of expansion. With productive capacity throughout the country recently increased, this lack of growth has lead to keen competition. The tendency for our customers to reduce their inventories has been accelerated and we have had to increase our stocks of finished goods in order to be in a position to provide the rapid delivery required.

During the year the company's research and development section has been considerably strengthened by the introduction of new personnel.

The Current Year

I am able to tell you that demand for your company's products and the trading profit of the Group in the early months of the year have at least been maintained by comparison with 1957. You will, however, appreciate that it is yet too early to forecast an improvement over the whole year—although we hope to avoid the heavy charge for stock depreciation that was suffered in 1957.

The inevitable increase in the use of electricity and the favourable position that your company is in to take advantage of any upsurge in economic activity encourages me to look forward to the future with confidence.

The report and accounts were adopted.

3663

POWER SECURITIES CORPORATION

Satisfactory Results

THE Thirty-fifth Annual General Meeting of Power Securities Corporation Limited will be held on 11th June in London.

The following is an extract from the circulated statement by the Chairman and Managing Director, Sir Andrew M. MacTaggart :—

The results for the year ended 31st December, 1957, can, I think, be regarded as satisfactory. As you will see from the Consolidated Profit and Loss Account, the gross profit at £1,330,700 was higher than that of the previous year by some £38,000. On the other side of the account, Depreciation is approximately £124,000 higher at £485,692, but this increase has been offset by the decrease in United Kingdom Taxation, which is some £130,000 less than in 1956. Part of such deduction is the estimated relief resulting from the transfer of part of our activities to a new subsidiary company which is expected to qualify as an Overseas Trade Corporation.

The Consolidated Net Profit at £373,948 compares with the previous year's figure of £222,680, but in that year £100,000 was provided for Contract Contingencies. Taking this into account the 1957 net profit shows an increase of some £51,000. Carrying down the Consolidated Net Profit, and adding Taxation over-provided and the balance brought forward from the previous year, there is a total of £756,722. The sum of £135,000 has been transferred to General Reserve, and your directors recommend the payment of a dividend on the Ordinary shares of 11%.

Fully Occupied

BALFOUR, BEATTY & CO. LIMITED, our principal engineering and construction company, have been fully occupied during the past year, both in the United Kingdom and overseas.

ELECTRICAL ENGINEERING

UNITED KINGDOM.—On the Electrical side, two of the three steam power stations which we have been authorised to construct for the Central Electricity Generating Board (formerly Central Electricity Authority), namely Staythorpe "A" (360 MW) and Carmarthen Bay (345 MW), both of which went into commission last year, have been generating up to full capacity during the current year. Our staff have been carrying out minor modifications and additions. Construction of the Staythorpe "B" Station, comprising three 120-MW turbo-alternator sets, started in April last year, and substantial progress has been made with the civil engineering work.

In the Nuclear Power field—where we are associated with the A.E.I.-John Thompson Nuclear Energy Company—work on the Berkeley Power Station has made excellent progress, and we are generally ahead of programme after the first full year of construction.

The Transmission Line Department has completed some 464 miles of high-tension lines and 120 miles of low-tension lines in the United Kingdom, despite continued restriction on capital expenditure and delays due to difficulties in obtaining wayleaves. We have in hand for the Central Electricity Generating Board, North of Scotland Hydro-Electric Board, South of Scotland Electricity Board and the East Midlands Electricity Board about 820 miles of high-tension and 162 miles of low-tension lines. Unfortunately, much of this work is seriously held up on account of wayleave difficulties.

OVERSEAS.—The British Columbia Electric Co. Ltd. have appointed us as consultants for the mechanical and electrical work and overall design of the Burrard Thermal Generating Station and substantial progress has been made with designs. This power station, which is near Vancouver, will be one of the largest thermal stations in the world, being designed to contain six turbo-alternator units having a total capacity of over 900 MW and six boiler units which will be fired by natural gas. We have opened an office in Vancouver and transferred an engineering design staff from our London office.

In Iraq we have been awarded a contract by the Iraq Development Board for 196 miles of 132-kV transmission lines in Northern Iraq, to be completed by next October. Work started in November, 1957, and already approximately two-thirds of the foundations have been completed, and over one-third of the towers erected. Conductor stringing has just started.

In Malaya the 24-MW extensions to the Malim Nawar Station of The Perak River Hydro-Electric Power Co. Ltd. are expected to be complete by the end of this year.

In Kenya the 250 miles of 132-kV transmission line from Tororo in Uganda to Nairobi was completed ahead of time, the bulk of the towers and the whole of the conductors having been erected within seven months up to August, 1957. The substations were completed shortly afterwards, and supply permanently established in the beginning of 1958. The Hon. Sir Evelyn Baring, G.C.M.G., K.C.V.O., the Governor of Kenya, formally brought the line into service on the 3rd March, 1958.

The 6-MW extension to the Nairobi South Diesel Power Station of The East African Power & Lighting Company Limited has been completed. Extensions to other smaller stations have been carried out during the year.

For the Tanganyika Electric Supply Company Limited extensions to hydro-electric and thermal power stations have been under construction during the year. The programme of hydro-electric developments on the Pangani River and associated transmission line, which was mentioned last year, has been deferred.

CIVIL ENGINEERING

UNITED KINGDOM.—On the Civil Engineering side, the Selset Reservoir, which we have under construction for the Tees Valley Water Board, has made good progress during the past year, and we are now in a position to maintain the programme during the coming year, subject to weather conditions. Many obstacles have been overcome on what has proved to be a very formidable task, and we are hopeful that the Water Board will show their appreciation at the appropriate time.

In London, the Notting Hill Gate contract for the London Transport Executive continues to make satisfactory progress and is keeping well to programme.

Our Civil Engineering branch in Scotland has had a satisfactory year with a miscellaneous assortment of works and, amongst others, at the moment they are engaged on a hydro-electric development near Dalwhinnie in Inverness-shire for the North of Scotland Hydro-Electric Board, and the construction of two shaft collars for the Scottish Division, National Coal Board, at their new Airth Colliery.

OVERSEAS.—We have recently arranged with the British Thomson-Houston Company Limited to carry out the design and supervision of the Civil Engineering works for Mata Steam Power Station in Barcelona.

In Iraq we continue to be busy with several works, the most important being the Faisaliyah Regulator, which is making good progress.

The Derbendi-Khan Road, which is a major work of road construction, having an estimated cost value of over £6,000,000, is now completely reorganised, and has made good progress since we took over the management.

Other works in Iraq are under construction, and we are hopeful of getting our fair share now that our competitors are beginning to appreciate the hazards.

Our Iraq subsidiary company, Murdoch & Brooks Ltd., are making good progress on the Mussayib Canalisation contract. This is quite an extensive work involving the construction of over 1,700 kilometres of canals of various sizes.

In Canada, Balfour, Beatty & Co. (Canada) Ltd. and their subsidiary company, Russell Construction Limited, have been very active during the year. The principal work in hand is the deepening of 4¾ miles of the Welland Canal by Russell Construction Limited for the St. Lawrence Seaway Authority. This work is now well under way, and is due for completion in the spring of 1959.

The Khulna paper-making factory in East Pakistan, to which I referred last year, is making good progress, and we have found a happy association with our Canadian friends, Provincial Engineering Limited.

Other Activities

TERSONS Ltd., our building company, have again had a very successful year and continue to expand in spite of the credit squeeze which has undoubtedly limited the rate of their expansion. The work they have in hand should ensure their being fully occupied for a full year ahead.

STENT PRECAST CONCRETE Limited have fully endorsed my forecast of last year by the results for 1957, and this company, as from the 1st January, 1958, became a subsidiary of Tersons Ltd. I look forward to continued expansion.

DUNCAN WATSON (Electrical Engineers) Limited have also become a subsidiary of Tersons Ltd. as from 1st January, 1958, and there should be a considerable improvement in the trading of this company due to this closer association with building interests.

METROPOLITAN CONSTRUCTION Company Limited had another profitable year and continue to get a fair share of the class of work in which they specialise.

JAMES KILPATRICK & SON Limited had a successful year, and continue to expand both at home and overseas, particularly in Iraq, where they are getting a good share of the work in which they are interested. During 1957 the design and supervision of the electrical installations at the successful British Trade Fair in Helsinki was undertaken, and the company was appointed in a similar capacity for the British Industries participation at the Brussels International Exhibition, a task of some extent and complexity.

Overseas Opportunities

BALFOUR BEATTY (Overseas) Limited.—In view of the increasing international competition for contracts overseas the provisions of the 1957 Finance Act regarding Overseas Trade Corporations were generally welcomed by United Kingdom companies operating abroad. In order to take advantage of the benefits available under the Act we formed a new company named Balfour Beatty (Overseas) Limited. As from 1st January, 1958, this company has been operating in Iraq, East Africa and Malaya, and its operations will be extended to other overseas territories as circumstances permit.

It is now over twelve years since the last world war terminated, at least officially, and what has been done by the so-called victors to adjust themselves to peace conditions? In some countries vested interests have undoubtedly played a large part, and it is easy for the political side to be influenced by such interests when it means full employment.

Surely, however, the adjusting period has been somewhat over-stressed, and there must be a more profitable way of using worldly wealth in the shape of raw materials than using it for the manufacture of so-called defence weapons.

I suggest that if the efforts and raw materials were diverted to the manufacture and supply of essentials required by the less developed nations to raise their standard of living, not necessarily up to Western European standards, but at least to what is known as human standards, and take away from peoples that constant fear of destruction, then we might look forward to a happier world.

Future wars are now at the mercy of scientists, apart from politicians, and if we have arrived at the stage that man, now having the scientific means within his power to destroy mankind, has decided to do so, then that in my opinion would be man's complete condemnation of nature, and all that it provides. That final influence, in my belief, will not rest with man.

The Commonwealth Nations hold out great possibilities to this country for the future, and Canada's new Prime Minister has already indicated in no uncertain terms how Canada would welcome a great expansion of trade with this country. Do not let us miss this wonderful opportunity. So far as this Corporation is concerned, it is our intention to continue to develop and expand the work which we started when we opened an office in Toronto four years ago, and we look forward to a closer collaboration with our kinsmen in that great Commonwealth country.

Aero Research Ltd. 49
Airedale Electrical & Mfg. Co. Ltd. 5
Albion Clay Co. Ltd. 47
Anders Electronics Ltd. 35
Arcolectric Switches Ltd. 16
Ashley Accessories Ltd. 79

Bakelite Ltd. 39
Baume & Co. Ltd. 86
Belling & Lee Ltd. 42
Bill Switchgear Ltd. 3
Birch, H. A., & Co. Ltd. 60
Birkbys Ltd. 15
Birlec Ltd. 80
Boxall, T. A., & Co. 62
Brentford Transformers Ltd. 52
British Driver-Harris Co. Ltd. 91
British Insulated Callender's Cables Ltd. 65
British Klockner Switchgear Ltd.... 67
British Switchgear Corporation Ltd. 107
Brookhirst Switchgear Ltd. 63
Brush Electrical Eng. Co. Ltd. 56b
Burdette, A., & Co. Ltd. 58
Burn, Geo., Ltd. 8

Churchouse, C. M., Ltd. 26
Clevedon Rivets & Tools Ltd. 90
Colne Switchgear (K & W) Ltd. 25
Connollys (Blackley) Ltd. 17
Cosmocord Ltd. 2
Cox-Walkers Ltd. 35
Crater Products Ltd. 51
Cressall Mfg. Co. Ltd. 85
Crofts (Engineers) Ltd. ..... 44 & 45
Crompton Parkinson Ltd. 48
Cryselco Ltd. 32

Daly (Condensers) Ltd. 62
Dorman & Smith Ltd. 59
Drummond, John (Engineers) Ltd. 64

Ega Electric Ltd. 108
Electric Depôt Ltd. 106
Electric Elements Co. 26
Elkay Electrical Mfg. Co. Ltd. 60
Enfield Cables Ltd. 6
English Electric Co. Ltd. 38
Evans, F. W., Ltd. 108
Everett Edgcumbe & Co. Ltd. 56

Ferranti Ltd. ..... 77 & 80
Field & Grant Ltd. 43
Fischer Bearings Co. Ltd. ..... Cover 3
Fitter & Poulton Ltd. 16
Flexello Castors & Wheels Ltd. 35

Fry's Metal Foundries Ltd. 84
Fuller Electric Ltd. 13

Gaskell & Grocott Ltd. 106
Geipel, W., Ltd. 26
General Electric Co. Ltd. .... 18, 19 & 96
Genristo Ltd. 22
Greenwood's & Airvac Ventilating Co. Ltd. 41

H.V.E. (Electric) Ltd. 16
Hackbridge & Hewittic Electric Co. Ltd. 30
Harvey, G. A., & Co. (London) Ltd. 31
Heatrae Ltd. 1
Henley's, W. T., Telegraph Works Co. Ltd. ..... 72 & 73
Heyes & Co. Ltd. 58
Hoffmann Mfg. Co. Ltd. 14
Howells (Electric Motors) Ltd. 54
Hyde, J. B., & Co. Ltd. 85

I.A.C. Ltd. 85
Igranic Electric Co. Ltd. 37
Imperial Chemical Industries Ltd. 87
Interohm Electrical Insulators Ltd. 94

Johnson, Matthey & Co. Ltd. 66
Johnson & Phillips Ltd. 20

Keyswitch Co. 14

Lancashire Dynamo Nevelin Ltd. ... 88
Lindsay & Williams Ltd. 108
Litholite Insulators & St. Albans Mouldings Ltd. 64
Liverpool Electric Cable Co. Ltd. ... 36
Londex Ltd. 90
London Electric Wire Co. & Smiths Ltd. (Company Meeting) 104

Maclaren, R., & Co. Ltd. 93
Martindale Electric Co. Ltd. 46
Metropolitan-Vickers Electrical Co. Ltd. ..... Cover 4 & 70
Midland Electric Mfg. Co. Ltd. 76
Monmer Foundry Ltd. 82
Morris, John, Electrical Eng'g Co. Ltd. 47

Nalder Bros. & Thompson Ltd. 11
Neco Geared Motors Ltd. 64
Neo Electrical Industries Ltd. 108

Ormond Eng. Co. Ltd. 7
Otter Controls Ltd. 59
Ottermill Switchgear Ltd. 56a

P & B Engineering Co. Ltd. 33
Partridge Wilson & Co. Ltd. 9
Parvalux Ltd. 81
Paxtons (Electrical) Ltd. 107
Pearce, A. (B'ham) Ltd. 90
Pirelli-General Cable Works Ltd. ... 69
Power Securities Corporation Ltd. (Company Meeting) 105

Quicksilver Tube Mnfg. Co. 107

Ratcliff, J. F. (Meta's) Ltd. 93
Record Electrical Co. Ltd. 68
Reyrolle, A., & Co. Ltd. ..... 28 & 29
Rist's Wires & Cables Ltd. ..... Cover 2
Rix, G. A. 90
Robinson, D., & Co. 106
Robinson, L., & Co. Ltd. 6
Rowlands Electrical Accessories Ltd. 25
Rozalex Ltd. 51
Ryman, F., Electrical Ltd. 82

Sanders, W., & Co. (Wednesbury) Ltd. 12
Santon Ltd. 53
Sax, Julius, & Co. Ltd. 82
Scottish Cables Ltd. ..... Cover 1
Simmonds Aerocessories Ltd. 78
Simplex Electric Co. Ltd. ..... 74 & 75
Sims, F. D., Ltd. 47
Smiths Industrial Instruments Ltd. 92
Sparklets Ltd. 60
Spencer & Sons (Market Harborough) Ltd. 86
Sperryn & Co. Ltd. 21

Standard Telephones & Cables Ltd. 24
Stockfield Mfg. Co. Ltd. 8
Stonebridge Electrical Co. Ltd. 93
Suffolk Iron Foundry (1920) Ltd.... 21

Taylor, Armand, & Co. Ltd. 43
Terry, Herbert, & Sons Ltd. 4
Transformer & Electrical Co. Ltd.... 81
Trumeter Co. Ltd. 60
Tubewrights Ltd. 71
Tudor Accumulator Co. Ltd. 57
Tufnol Ltd. 23
Tungstone Products Ltd. 82

Universal Electrical Co. 108

Veritys Ltd. 95
Victor Products (Wallsend) Ltd. ... 81
Volex Electrical Products Ltd. 83

Wades (Halifax) Ltd. 22
Walsall Conduits Ltd. 10
Walters, Austin, & Son Ltd. 14
Wandleside Cable Works Ltd. 40
Western Diecasting Ltd. 51
Westinghouse Brake & Signal Co. Ltd. 50
Westminster Eng. Co. Ltd. 25
Wootton & Co. Ltd. 31

Yorkshire Electric Transformer Co. Ltd. 27
Yorkshire Switchgear & Eng. Co. Ltd. 61

Advertisement copy and blocks for printing in black and white should reach us 16 days preceding date of issue addressed to Electrical Review, Dorset House, Stamford Street, London, S.E.1

PORCELAINS
for the Electrical and Allied Trades

GASKELL & GROCOTT LTD.
Whitehall Works, Porthill, Staffs
Telephone: Stoke-on-Trent 84611-3

RODENE TIMERS
FOR MOST AUTOMATIC CONTROL NEEDS!

The "Rodene" high torque instant start, synchronous Timer-Motor with built-in automatic clutch.

Self-reset and Multi-cam Timers.

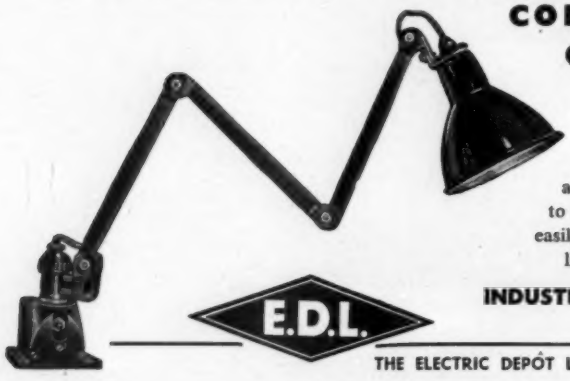
Made in England.

SEND FOR LIST R.I.

D. ROBINSON & CO. Tel: Hounslow 6266/7
717 LONDON ROAD, HOUNSLOW, MIDDX.

CONCENTRATION ON THE JOB

Concentration produces results. We are specialists in Industrial Local Lighting. E.D.L. lamps throw a clear, shadow-free light right on to the job. They are sturdy, easily adjusted, free from sag. Get full lighting efficiency—with E.D.L.



E.D.L.

INDUSTRIAL LOCAL LIGHTING FITTINGS
for mains or low voltage

THE ELECTRIC DEPOT LTD., PRITCHETT STREET, BIRMINGHAM 6 Phone: ASTon Cross 1381

ELECTRIC SHOCK

ALL MEN ENGAGED DIRECTLY OR INDIRECTLY IN ELECTRICAL WORK SHOULD KNOW THOROUGHLY A METHOD OF RESTORING VICTIMS OF ELECTRIC SHOCK

INSTRUCTION SHEET

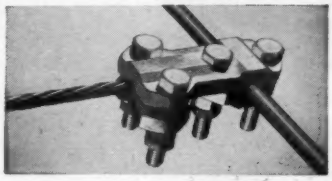
based on the HOLGER NIELSEN System and specially prepared by the Editorial Staff of

ELECTRICAL REVIEW

Well illustrated and printed in colour to simplify essential actions

Obtainable from
PUBLISHING DEPT.
DORSET HOUSE
STAMFORD STREET
LONDON · SE1

The "ELECTRICAL REVIEW" Wall Sheet, 20 in. x 15 in., printed in red and black, is available on chrome art paper at 8d. each (by post 10½d.), mounted on cardboard and varnished 5s. (by post 6s. 6d.), printed direct on aluminium sheet and varnished 8s. (by post 9s. 6d.).



Solderless UNIVERSAL CONNECTORS

FOR ALL CONNECTIONS AND TYPES OF CONDUCTORS

BRITISH SWITCHGEAR CORPORATION LTD.
MAKERS OF H.T. SWITCHGEAR
Morden Factory Estate, London, S.W.19
LIB 2273-5

MERCURY SWITCHES

will solve your switching problems
We offer completely reliable switches coupled with good delivery

Write for catalogue

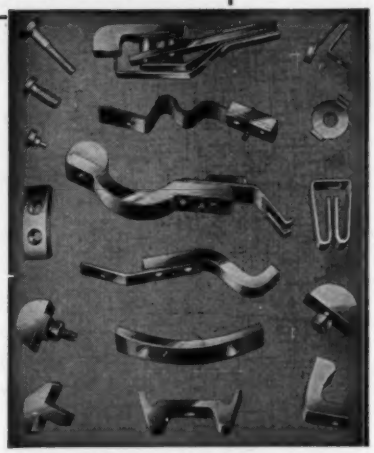
QUICKSILVER TUBE MFG. COMPANY
Willow Road, Poyle Estate, Colnbrook, Bucks.
Tel.: Colnbrook 2382

CONTACTS

for maintenance or production

A DOZEN OR A MILLION

A.I.D. Approved



Contacts for every electrical purpose in any metal. Switch and Control Gear spares for every type of British or Foreign Gear. Any Quantity. We supply hundreds of maintenance electrical engineers and switchgear manufacturers throughout the world.

PAXTONS (ELECTRICAL) LTD.
WESTON – SUPER – MARE
Telephone: 1357

MEGOHMOID

A specialised service to cable manufacturers . . .

Lindsay & Williams LIMITED

Proofed Insulating Cloths and Tapes for Rubber and Power Cables
Bitumenised Hessian and Bitumenised Cotton Tapes
Adhesive Insulating Tapes

MEGOHMOID TRADE MARK REGISTERED

LINDSAY & WILLIAMS LIMITED *Established 1912*

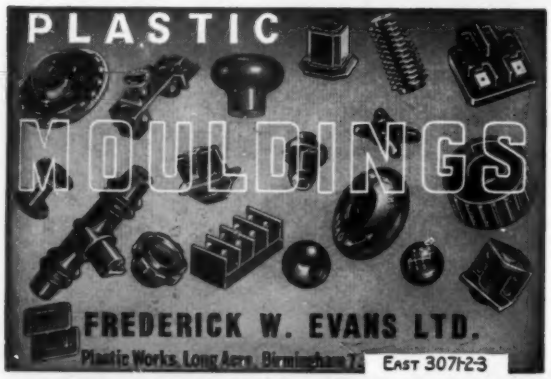
OPENSHAW BRIDGE WORKS, MANCHESTER 11

Telephone: EASt 2686 (4 Lines)
"Telex 66269"

Grams:
"Megohm Telex Manchester"

M101

PLASTIC MOULDINGS



FREDERICK W. EVANS LTD.
Plastic Works, Long Acre, Birmingham 7. EAST 3071-2-3

neo - MAINTEST

POTENTIAL INDICATORS FOR VOLTAGES UP TO **33 kV**

SAFETY factor in Industry demands simple and safe inspection

List No. LHT.107

Designed for vertical and horizontal isolation switchgear
COLLIERIES
SUPPLY AUTHORITIES
INDUSTRIAL CONSUMERS

NEO ELECTRICAL INDUSTRIES LTD.
MANCHESTER 4

HOUSE SERVICE METERS

Credit Pattern and Prepayment Type
200-240 v. A.C. S/Ph 50 c. (& D.C.)
AVAILABLE FROM STOCK
POLYPHASE 400-440 v. 3-Wire Type
Ex Stock

UNIVERSAL ELECTRICAL CO.
217-221 City Road, London, E.C.1

EGATUBE LEADS THE FIELD IN NON-METALLIC CONDUIT & FITTINGS

EGA

Send for leaflet 620/6

EGA ELECTRIC LIMITED
HOLYHEAD ROAD · WEDNESBURY · STAFFS
Telephone: WEDnesbury 0911/5

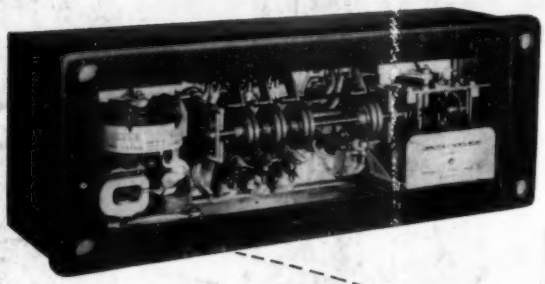
Published by ELECTRICAL REVIEW PUBLICATIONS LTD., at Dorset House, Stamford Street, London, S.E.1
and printed in Great Britain at THE CHAPEL RIVER PRESS, Andover, Hants.

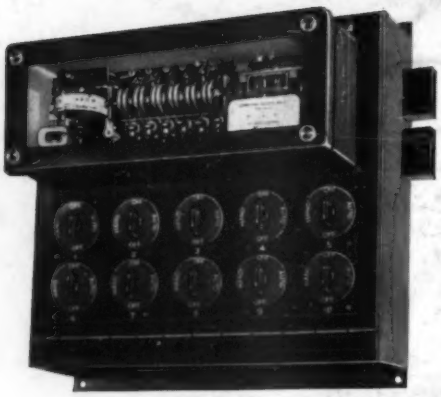
FBC
MINIATURE
BEARINGS
range in size from 1·5 mm. o.d. to 10 mm. o.d. Some are made with open cups which allow clearance for spindle extensions, ranging from 0·25 to 2 mm. Full particulars and sizes are available on application.
The bearings illustrated are actual size.
ALL-BRITISH
FBC
F.B.C.
FISCHER
Regd. Trade Marks
FISCHER BEARINGS CO. LTD.,
WOLVERHAMPTON

Choose Metrovick relays and correct Power Factor AUTOMATICALLY

Type NJO4 relay for the control of single-step power capacitors.

A complete range of Metrovick relays is available for the control of capacitors as a means of improving the power-factor of industrial loads. Please write for full details.





Type NJO3 relay for the control of a number of capacitors or capacitor sections in sequence. It may be switchboard or wall-mounting pattern with or without control switches.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

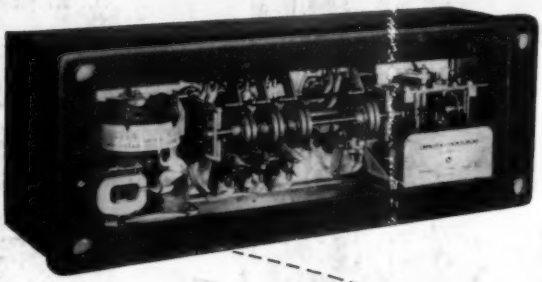
An A.E.I. Company

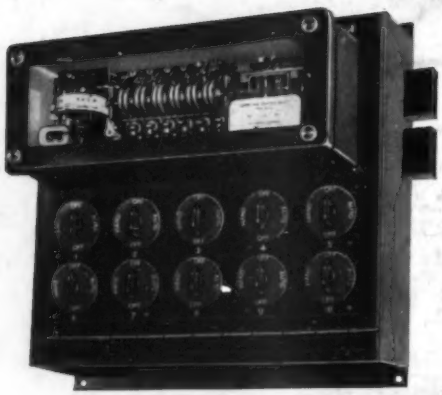
G/A 704

Choose Metrovick relays and correct Power Factor AUTOMATICALLY

Type NJO4 relay for the control of single-step power capacitors.

A complete range of Metrovick relays is available for the control of capacitors as a means of improving the power-factor of industrial loads. Please write for full details.

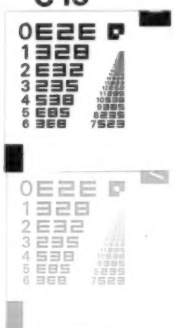




Type NJO3 relay for the control of a number of capacitors or capacitor sections in sequence. It may be switchboard or wall-mounting pattern with or without control switches.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

An A.E.I. Company

G/A 704

C15